Refine Search

Search Results -

Terms	Documents
L10 and (compar$ same data)	2

Database:

- US Pre-Grant Publication Full-Text Database
- US Patents Full-Text Database
- US OCR Full-Text Database
- EPO Abstracts Database
- JPO Abstracts Database
- Derwent World Patents Index
- IBM Technical Disclosure Bulletins

Search: L21

Refine Search

Recall Text Clear Interrupt

Search History

DATE: Sunday, November 13, 2005 Printable Copy Create Case

Set Name side by side	Query	Hit Count	Set Name result set
	DB=PGPB; THES=ASSIGNEE; PLUR=YES; OP=OR		
L21	L10 and (compar$ same data)	2	L21
L20	L10 and (compar$ and predict$)	2	L20
L19	L13 and (compar$ and predict$)	0	L19
L18	L13 and (compar$ same predict$)	0	L18
L17	L10 and position$	2	L17
L16	L10 and predict$	2	L16
	DB=USPT; THES=ASSIGNEE; PLUR=YES; OP=OR		
L15	L10 and position$	0	L15
L14	L13 and predict$	0	L14
L13	6748318.pn.	1	L13
	DB=PGPB; THES=ASSIGNEE; PLUR=YES; OP=OR		
L12	6748318.pn.	0	L12
L11	L10 and (pattern$ with recogni$)	2	L11

L10	20050060069 or 20050137786	2	L10

DB=PGPB,USPT,USOC,EPAB,JPAB,DWPI,TDBD; THES=ASSIGNEE; PLUR=YES; OP=OR

L9	L8 and l7	2	L9
L8	701/23-25,200-201,207-210,213.ccls.	7759	L8
L7	L6 and (pattern$ with recogni$)	27	L7
L6	L5 and compar$	27	L6
L5	L4 and ((predict or forecast$) with (destinat$ or address$ or location$))	27	L5
L4	L3 and (navigat$ with vehicle)	151	L4
L3	(pattern$ with data with recogni$)	12703	L3

DB=USPT; THES=ASSIGNEE; PLUR=YES; OP=OR

L2	L1 and (pattern$ or recogni$)	2	L2
L1	6748318.pn. or 6567745.pn.	2	L1

END OF SEARCH HISTORY

Hit List

First Hit | Clear | Generate Collection | Print | Fwd Refs | Bkwd Refs | Generate OACS

Search Results - Record(s) 21 through 29 of 29 returned.

☐ 21. Document ID: US 6859728 B2

Using default format because multiple data bases are involved.

L32: Entry 21 of 29 File: USPT Feb 22, 2005

US-PAT-NO: 6859728
DOCUMENT-IDENTIFIER: US 6859728 B2

TITLE: Navigation system

DATE-ISSUED: February 22, 2005

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Sakamoto; Kiyomi	Ikoma			JP
Nomura; Noboru	Kyoto			JP
Kubota; Shinji	Daito			JP

US-CL-CURRENT: 701/211

Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | Claims | KWIC | Draw De

☐ 22. Document ID: US 6807483 B1

L32: Entry 22 of 29 File: USPT Oct 19, 2004

US-PAT-NO: 6807483
DOCUMENT-IDENTIFIER: US 6807483 B1

TITLE: Method and system for prediction-based distributed navigation

Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | Claims | KWIC | Draw De

☐ 23. Document ID: US 6278942 B1

L32: Entry 23 of 29 File: USPT Aug 21, 2001

US-PAT-NO: 6278942
DOCUMENT-IDENTIFIER: US 6278942 B1

TITLE: Method and system for providing routing guidance

Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | Claims | KWIC | Draw De

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☐ 24. Document ID: US 6101443 A
L32: Entry 24 of 29 File: USPT Aug 8, 2000

US-PAT-NO: 6101443
DOCUMENT-IDENTIFIER: US 6101443 A

TITLE: Route search and navigation apparatus and storage medium storing computer programs for navigation processing with travel difficulty by-pass

Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | Claims | KWIC | Draw De

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☐ 25. Document ID: US 6011494 A
L32: Entry 25 of 29 File: USPT Jan 4, 2000

US-PAT-NO: 6011494
DOCUMENT-IDENTIFIER: US 6011494 A

TITLE: Portable or vehicular navigating apparatus and method capable of displaying bird's eye view

Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | Claims | KWIC | Draw De

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☐ 26. Document ID: US 5910788 A
L32: Entry 26 of 29 File: USPT Jun 8, 1999

US-PAT-NO: 5910788
DOCUMENT-IDENTIFIER: US 5910788 A

TITLE: Predictive approach integrity

Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | Claims | KWIC | Draw De

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☐ 27. Document ID: US 5793310 A
L32: Entry 27 of 29 File: USPT Aug 11, 1998

US-PAT-NO: 5793310
DOCUMENT-IDENTIFIER: US 5793310 A

TITLE: Portable or vehicular navigating apparatus and method capable of displaying bird's eye view

Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | Claims | KWIC | Draw De

☐ 28. Document ID: US 5714948 A
L32: Entry 28 of 29 File: USPT Feb 3, 1998

US-PAT-NO: 5714948
DOCUMENT-IDENTIFIER: US 5714948 A

TITLE: Satellite based aircraft traffic control system

Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | Claims | KWIC | Draw De

☐ 29. Document ID: US 5416713 A
L32: Entry 29 of 29 File: USPT May 16, 1995

US-PAT-NO: 5416713
DOCUMENT-IDENTIFIER: US 5416713 A

TITLE: Obstacle avoidance apparatus

Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | Claims | KWIC | Draw De

Clear | Generate Collection | Print | Fwd Refs | Bkwd Refs | Generate OACS

Terms	Documents
L30 and (compar$ with position)	29

Display Format: - Change Format

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L38: Entry 5 of 7 File: PGPB Oct 11, 2001

PGPUB-DOCUMENT-NUMBER: 20010029425
PGPUB-FILING-TYPE: new
DOCUMENT-IDENTIFIER: US 20010029425 A1

TITLE: Real time vehicle guidance and traffic forecasting system

PUBLICATION-DATE: October 11, 2001

INVENTOR-INFORMATION:

NAME	CITY	STATE	COUNTRY
Myr, David	Jerusalem		IL

APPL-NO: 09/800116 [PALM]
DATE FILED: March 6, 2001

RELATED-US-APPL-DATA:
child 09800116 A1 20010306
parent continuation-in-part-of 09528134 20000317 US PENDING

INT-CL: [07] G01 C 21/28

US-CL-PUBLISHED: 701/200; 701/213
US-CL-CURRENT: 701/200; 701/213

REPRESENTATIVE-FIGURES: 1

ABSTRACT:

Real time vehicle guidance by central traffic unit is provided by a system which includes a central traffic unit, a plurality of vehicles equipped with mobile guidance units, and communication system based on GSM/GPS technology. The central traffic unit maintains the perpetually updated database of travel times for all sections of roads, while mobile guidance units include mobile cell phone handset units located in mounting receptacles (and used for determining their present position) and communicatively linked to the central traffic unit computer server. Mobile guidance units also comprise smart card capable to detect when a mobile cell phone unit is located in the mounting receptacle. All vehicles in which mobile cell phone units are so located can be used as probe vehicles. The central traffic unit uses those probe vehicles as antennas by tracking their positions for creating and maintaining a network of real time traffic load disposition in various geographical areas. To be able to detect a bottleneck situation when it arises and to estimate a current travel time for a corresponding section of road, the central traffic unit maintains a list of probe vehicles that have recently exited that section. If the times those vehicles have spent on the section differ considerably from a regular travel time stored in the database, the central traffic unit uses statistical tools for forecasting the future travel time along this section. In response to a request from a driver for a route update from his present position to a desired destination

communicated via mobile phone to the central traffic unit, the central traffic unit calculates the desired fastest route by utilizing both the regular travel times along segments of roads and predicted current travel times calculated by using information collected from probe vehicles. By appropriately combining those travel times, the central traffic unit calculates the fastest route based on the most updated information on traffic load disposition. Thereafter the route is communicated to the corresponding mobile guidance unit for displaying it on the computer screen and/or communicating it to the driver by voice. Moreover, the guidance system allows the driver to enter alternative time schedules for the same destination and receive alternative travel time estimates reflecting different estimated travel times along the roads at different times. Additionally, the central traffic unit can relate to the driver new and updated information on current traffic jams, slow-down bottleneck situations, etc. in a

CROSS REFERENCE TO RELATED APPLICATION

[0001] This application is a continuation-in-part of U.S. patent application Ser. No. 09/528,134, filed Mar. 17, 2000.

Previous Doc Next Doc Go to Doc#

L38: Entry 6 of 7 File: USPT Sep 6, 2005

US-PAT-NO: 6941222
DOCUMENT-IDENTIFIER: US 6941222 B2

TITLE: Navigation system, server system for a navigation system, and computer-readable information recorded medium in which destination prediction program is recorded

DATE-ISSUED: September 6, 2005

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Yano; Kenichiro	Tsurugashima			JP
Myochin; Kiyonori	Tokyo-to			JP
Yamauchi; Keiichi	Tsurugashima			JP

ASSIGNEE-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY	TYPE CODE
Pioneer Corporation	Tokyo-to			JP	03

APPL-NO: 10/132570 [PALM]
DATE FILED: April 26, 2002

FOREIGN-APPL-PRIORITY-DATA:

COUNTRY	APPL-NO	APPL-DATE
JP	P2001-132896	April 27, 2001

INT-CL: [07] G01 C 21/26, G01 C 21/30

US-CL-ISSUED: 701/209; 701/202, 340/995.1, 340/995.17, 340/995.18, 342/359
US-CL-CURRENT: 701/209; 340/995.1, 340/995.17, 340/995.18, 342/359, 701/202

FIELD-OF-SEARCH: 701/202, 701/207, 701/209, 701/210, 701/213, 701/208, 701/211, 701/216, 340/995.14, 340/990, 340/995.1, 340/995.17, 340/995.18, 340/995.23, 340/995, 340/988, 455/456.1, 455/441, 342/359, 342/357.06, 342/357.13

PRIOR-ART-DISCLOSED:

U.S. PATENT DOCUMENTS

Search Selected Search ALL Clear

PAT-NO	ISSUE-DATE	PATENTEE-NAME	US-CL
5897602	April 1999	Mizuta	701/201

☐	5902349	May 1999	Endo et al.	701/202
☐	5912635	June 1999	Oshizawa et al.	340/988
☐	5991688	November 1999	Fukushima et al.	701/209
☐	6188956	February 2001	Walters	701/200
☐	6212472	April 2001	Nonaka et al.	701/208
☐	6249740	June 2001	Ito et al.	701/200
☐	6263276	July 2001	Yokoyama et al.	701/207
☐	6282492	August 2001	Gorai et al.	701/209
☐	6285950	September 2001	Tanimoto	701/201
☐	6314369	November 2001	Ito et al.	701/209
☐	6330453	December 2001	Suzuki et al.	455/456
☐	6360167	March 2002	Millington et al.	701/211
☐	2001/0007089	July 2001	Takeuchi	701/211
☐	2001/0027375	October 2001	Machida et al.	701/209
☐	2001/0053956	December 2001	Ohishi et al.	701/209

FOREIGN PATENT DOCUMENTS

FOREIGN-PAT-NO	PUBN-DATE	COUNTRY	CLASS
07004977	January 1995	JP	

ART-UNIT: 3663

PRIMARY-EXAMINER: Black; Thomas G.

ASSISTANT-EXAMINER: To; Tuan C

ATTY-AGENT-FIRM: Sughrue Mion, PLLC

ABSTRACT:

A navigation system is provided that allows an appropriate destination point to be set when a vehicle begins to travel without an operator setting a destination point. A navigation system is provided with a system control section and, if a vehicle begins to travel without an operator setting a destination point, destination point information is retrieved. This destination point information is stored in a travel information database on the basis of information about the position of the vehicle, the direction in which the vehicle is progressing and information about the road. The road is which the vehicle is traveling along that was calculated based on the respective signals input from a GPS receiving section and various sensor sections. In addition, if there are candidates for the relevant destination point, candidate destination points are displayed on a display section as predicted destination points.

31 Claims, 4 Drawing figures

L38: Entry 4 of 7 File: PGPB Oct 24, 2002

DOCUMENT-IDENTIFIER: US 20020156572 A1
TITLE: Method of compiling navigation route content

Current US Classification, US Primary Class/Subclass:
701/209

Summary of Invention Paragraph:
[0002] Vehicle drivers seek to find the optimum routes from their origin point to their destination point so they can minimize travel time and fuel consumption. Current methods for finding optimum routes are based on static digital road map databases and limited real-time traffic monitoring equipment. Typically, the road map data is used to compute optimal routes based on estimated travel times from the road classification and/or speed limit data. This method has the disadvantage in that the data may not reflect the actual travel times because of stop signs, normal traffic patterns, weather and road conditions, accidents, construction, and the like. Real-time traffic monitoring equipment is currently available only on some major freeways and arteries. This leaves potential routes out of reach of real-time traffic monitoring and hence unreliable for incorporation into a route optimization scheme.

Summary of Invention Paragraph:
[0003] Optimum routes are generally computed based on weighting strategies for road segments and intersections. The real-time traffic information is treated as a dynamic weight for the individual road segments affected and routes can be computed taking the traffic into consideration where available. These route calculation methods are based on available static data and limited real-time traffic information. This has the disadvantage of improper weighting of road segments due to a lack of real-time traffic data for any given time of the day or week, which in turn creates sub-optimal routing schemes.

Detail Description Paragraph:
[0018] Traffic servers 142 can contain traffic information including, but not limited to, traffic reports, traffic conditions, speed data, and the like. Route servers 140 can contain information including, but not limited to, digital road map data, route alternatives, route guidance, route algorithms, route storing algorithms, and the like. Communications node gateway 138 is also coupled to map databases 146, which can comprise distributed map database and traffic databases 148. Map databases 146 contain additional digital roadmap data. Traffic databases 148 can contain traffic information, for example, traffic conditions, road closures, construction, and the like. POI servers 144 can contain information for points of interests such as gasoline stations, restaurants, motels, movie theatres, and the like.

Detail Description Paragraph:
[0021] Communications node gateway 138 is coupled to remote communications node gateway 136. Remote communications node gateway 136 is coupled to various navigation applications, which can include, without limitation, route guidance application(s) 128, traffic application(s) 130, POI application(s) 132, navigation route algorithm 204, route storing algorithm 123, and the like. Navigation applications 128, 130, 132, 204, 123 are coupled to, and can process data received

from internal and external positioning device(s) 134. Internal positioning device (s) 134 are located within remote communications node 104 or vehicle 108 and can include, for example global positioning system (GPS) unit(s), speedometer, compass, gyroscope, altimeter, and the like. Examples of positioning device(s) 134 external to remote communications node 104 are, without limitation, differential GPS, network-assisted GPS, wireless network positioning systems, and the like.

Detail Description Paragraph:
[0024] Remote communications node 104 can optionally contain and control one or more digital storage devices 126 to which real-time broadcasts and navigational data can be digitally recorded. The storage devices 126 may be hard drives, flash disks, or other storage media. The same storage devices 126 can also preferably store digital data that is wirelessly transferred to remote communications node 104 in faster than real-time mode.

Detail Description Paragraph:
[0025] In FIG. 1, communications node 102 and remote communications node 104, perform distributed, yet coordinated, control functions within distributed communications system 100. Elements in communications node 102 and elements in remote communications node 104 are merely representative, and distributed communications system 100 can comprise many more of these elements within other communications nodes and remote communications nodes.

Detail Description Paragraph:
[0029] Navigation route content 202 can include, without limitation, position data, velocity data, time data, and the like, received real-time from any portion of a navigation route traveled by remote communications node 104 or selected by a user via user configuration device 116. Examples of time data include, but are not limited to total travel time of the navigation route 306, intermediate travel times of individual route links, time of day, day of the week, and the like. Examples of velocity data include, but are not limited to average velocity, instantaneous velocity, and the like, which can also be for a given time of day or day of the week. Position data can include two-dimensional or three-dimensional coordinate data of the position of remote communications node 104. Navigation route content 202 is based on a navigation route defined by a user of remote communications node 104 in a distributed communications system 100.

Detail Description Paragraph:
[0030] Navigation anomaly data 208 can include real-time traffic data collected using installed sensors along or in the road, video cameras, accident reports, airborne traffic monitors, and the like. Traffic incidents such as accidents, stalls, construction, weather, delays, and the like, are reported with a location associated with a road segment in a digital map database.

Detail Description Paragraph:
[0031] Navigation route data 206 can include, without limitation, information on route links associated with a particular navigation route. For example, navigation route data 206 can include position data, velocity data, time data and the like already collected from remote communications node 104. Navigation route data 206 can also include historical travel time data from traffic observations aggregated over time from one or more users. Navigation route data 206 can also include data from static digital road map databases, road segments, route links, and the like. Road segments are elements in a digital road map database that represent route links in the actual road network. Route links are defined as sections of the roadway between intersections. Route links are road segments that are incorporated into a computed or defined navigation route. Navigation route data 206 computed by navigation route algorithm 204 can be processed to provide optimum navigation route 210, which can be a set of route links that optimizes or minimizes travel time, travel distance, and the like, between a starting location and a destination location. The invention is not limited to minimizing travel time or distance

traveled. Other factors can also be maximized, minimized, and the like, and are within the scope of the invention.

Detail Description Paragraph:
[0034] In operation, a user of remote communications node 104 defines navigation route 306 between starting location 302 and destination location 304 either directly or indirectly. Navigation route 306 is comprised of a plurality of route links 320, 322, 324, 326, 328, 330 and 332 (hereinafter designated 320-332). The user can define navigation route 306 by, for example, logging onto a trip planning website on distributed communications system 100 via user configuration device 116 and entering starting location 302 and destination location 304. Various routes between starting location 302 and destination location 304 stored in communications node 102, specifically route servers 140, and are communicated to the user. The user can then select a route offered or modify the route by adding and deleting route links as needed. When the navigation route 306 is complete, it is saved at communications node 102 and communicated to remote communications node 104. This is an example of a user directly defining navigation route 306.

Detail Description Paragraph:
[0036] Another example of defining navigation route includes a user driving a vehicle 108 with remote communications node 104 normally in his/her daily activities. Utilizing positioning devices 134, navigation route algorithm 204 and route storing algorithm 123 in remote communications node 104, the start and stop times, locations, and the like, of remote communications node 104 are recorded, for example, by monitoring the on/off position of the ignition switch of vehicle 108. Starting location 302 is compared to any previously defined starting location 308 and flagged if starting location is within a certain distance or radius 310 of previously defined starting location 308. If starting location is flagged, route storing algorithm 123 will begin recording navigation route content 202. Destination location 304 is compared to any previously defined destination location 312 and flagged if destination location 304 is within a certain distance or radius 314 of previously defined destination location 312. If destination location 304 is flagged, remote communications node 104 and route storing algorithm 123 will end recording of navigation route content 202. Navigation route content 202 for navigation route 306 is then stored and communicated to communications node 102 immediately or at some future time. If destination location 304 is not flagged as being within radius 314 of previously define destination location 312, remote communications node 104 can either keep navigation route content 202 recorded and define a new navigation route 306 or discard navigation route content 202 already recorded since it did not correspond to a previously traveled navigation route. When a recurring route is identified and communicated to communications node 102, the navigation route data 206 can be used to match the specific route links used in the route. This is an example of indirectly defining navigation route 306 by automatically monitoring the driving pattern of an individual user via remote communications node 104. Radius 310, 312 can be defined by a user or be assigned a default value for any particular starting location 302 or destination location 304.

Detail Description Paragraph:
[0037] Once a navigation route 306 is defined, plurality of route links 320-332 can be overlaid onto digital roadmap 360 for ease of viewing and editing. The defining coordinates of route links 320-332 can then be communicated to the remote communications node 104. Once a navigation route 306 is communicated to the remote communications node 104, plurality of route links 320-332 traversed by remote communications node 104 are monitored. When the starting location 302 and destination location 304 comport with previously defined starting and destination locations 308, 312 as described above, navigation route content 202 is recorded for each of the plurality of route links 320-332. Navigation route content 202 is recorded at intervals 350 along navigation route 306. Intervals 350 can be regular or irregular and can be defined by a user or automatically via route storing

algorithm 123. Intervals 350 can be defined by distance traveled, time elapsed, changes in speed or direction, passing the coordinates of the end points of route links 320332, and the like. Intervals 350 can also be defined by any distance or time between the end points of route lines 320-332. For example, intervals can be defined at each route alternative, which is at each point along one or more route links 320-332 where an alternate route diverges from route links 320-322. Navigation route content 202 is also communicated to communications node 102 and stored at regular intervals. The distance and/or time between intervals can be adjusted so that route storing algorithm can identify individual route links 320-332 along navigation route 306 to ensure navigation route content 202 is as accurate and precise as possible. In a preferred embodiment, the time to travel between pairs of end points of each route link is stored when the coordinates of the route links are available in remote communications node 104. Using these points to measure the travel times will make it convenient and accurate when the navigation route content 202 is compiled and interpreted by navigation route algorithm 204. As an example, and without limitation, navigation route content 202, which can include time data (time of day, week, etc.), velocity data (speed and direction) and position data (GPS coordinates, and the like) is recorded at intervals and communicated to communications node 102.

Detail Description Paragraph:
[0038] Navigation route content 202 can be communicated to communications node 102 at convenient time intervals throughout the day, week, and the like. For example, navigation route content 202 can be communicated to communications node 102 on a daily basis, weekly basis, or when the user of remote communications node 104 is utilizing another service. In one embodiment, navigation route content 202 is communicated to communications node 102 before or after a navigation route 306 is downloaded to remote communications node 104. However, the scope of the invention includes communicating navigation route content 202 to communications node 104 at any time or any number of intervals to provide for efficient communication of navigation route content 202.

Detail Description Paragraph:
[0040] Utilizing navigation route data 206, an optimum navigation route 210 can be generated between starting location 302 and destination location 304. Navigation route algorithm 204 can select the plurality of route links 320-332 that minimize travel time, travel distance, and the like, between starting location 302 and destination location 304. When optimizing navigation route 306, navigation route algorithm 204 can incorporate navigation anomaly content including real-time traffic incidents such as accidents, construction, weather and the like. Therefore, an optimum navigation route 210 can change depending on real-time conditions and the continuous input of navigation route content 202 received from users of a specific navigation route 306 between starting location 302 and destination location 304.

Detail Description Paragraph:
[0041] Optimum navigation route 210 and navigation route data 206 can also be utilized to predict arrival time at destination location 304 from a given departure time from starting location 302. The arrival time can be updated via remote communications node 104 during the journey as additional navigation route content 202 and navigation anomaly content 208 are received at communications node 102, compiled and communicated to remote communications node 104.

Detail Description Paragraph:
[0042] Optimum navigation route 210 and navigation route data 206 can also be utilized to predict an optimum departure time from starting location 302 to destination location 304 that will minimize travel time or distance or the like.

Detail Description Paragraph:
[0043] Navigation route data 206 can also be utilized to predict alternate routes

besides optimum navigation route 210 that may be more optimum at a given time due to navigation anomaly content 208. The alternate route can be communicated automatically to remote communications node 104 or user configuration device 116.

Detail Description Paragraph:
[0050] In step 518, navigation route content 202 is compiled and stored by navigation route algorithm 204. In step 520, navigation route data 206 is calculated from navigation route content 202 for navigation route 306 between starting location 302 and destination location 304. Navigation route data 206 can be historical and predictive data for navigation route 306 so that future users can make use of it to plan trips. In step 522, plurality of route links 320-332 of navigation route 306 are overlaid onto digital roadmap 360 for ease of use and editing by users.

Detail Description Paragraph:
[0051] In step 524, navigation route data 206 is optimized for navigation route 306 so as to provide plurality of route links 320-332 to operate to minimize travel time, travel distance, and the like between starting location 302 and destination location 304. In optimizing, navigation anomaly content 208 is also input into navigation route algorithm to account for real-time traffic incidents and other delays on an otherwise optimized route. This can have the effect of changing the plurality of route links that culminate in optimum navigation route 210. The foregoing steps can be repeated as often as necessary per the return arrow 526.

Detail Description Paragraph:
[0053] The method of the invention offers the advantage of collecting actual travel information from users and using that information as a component of generating customized traffic reports and optimizing navigation routes. The method of the invention also has the advantage of knowing and tracking the plurality of route links being traveled precisely including position, time and velocity data for each of the route links. This allows the creation of a highly accurate and optimized navigation route data that is updated in real-time by a plurality of users defining their own navigation routes. This has the advantage of allowing navigation route algorithm 204 to calculate an increasingly optimal navigation route for use by existing and subsequent users of the roadway network and allowing users to save additional time and cost in reaching their destinations.

CLAIMS:

6. The method of claim 1, wherein the navigation route content comprises position data for each of the plurality of route links of the navigation route.

8. The method of claim 1, wherein the navigation route content comprises time data for each of the plurality of route links of the navigation route.

12. The method of claim 1, further comprising optimizing the navigation route utilizing the navigation route data, wherein the navigation route algorithm selects the plurality of route links to minimize travel time between the starting location and the destination location.

13. The method of claim 1, further comprising optimizing the navigation route utilizing the navigation route data, wherein the navigation route algorithm selects the plurality of route links in order to minimize travel distance between the starting location and the destination location.

19. The computer-readable medium in claim 14, wherein the navigation route content comprises position data for each of the plurality of route links of the navigation route.

21. The computer-readable medium in claim 14, wherein the navigation route content

comprises time data for each of the plurality of route links of the navigation route.

25. The computer-readable medium in claim 14, further comprising optimizing the navigation route utilizing the navigation route data, wherein the navigation route algorithm selects the plurality of route links to minimize travel time between the starting location and the destination location.

26. The computer-readable medium in claim 14, further comprising optimizing the navigation route utilizing the navigation route data, wherein the navigation route algorithm selects the plurality of route links in order to minimize travel distance between the starting location and the destination location.

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L7: Entry 1 of 3 File: PGPB Oct 9, 2003

PGPUB-DOCUMENT-NUMBER: 20030191563
PGPUB-FILING-TYPE: new
DOCUMENT-IDENTIFIER: US 20030191563 A1

TITLE: Method and apparatus using historical data to associate deferral procedures and fault models

PUBLICATION-DATE: October 9, 2003

INVENTOR-INFORMATION:

NAME	CITY	STATE	COUNTRY
Eagleton, Stephen P.	Chandler	AZ	US
Felke, Timothy J.	Glendale	AZ	US

APPL-NO: 10/116182 [PALM]
DATE FILED: April 3, 2002

INT-CL: [07] G06 F 19/00

US-CL-PUBLISHED: 701/29; 701/3
US-CL-CURRENT: 701/29; 701/3

REPRESENTATIVE-FIGURES: 1

ABSTRACT:

A method of associating deferral procedures to a fault model for complex systems based on historical data, the method including the steps of: analyzing historical data for deferral information to identify deferral procedures; associating each of the deferral procedures with a corresponding one or more standard repairs; linking each of the standard repairs with a fault code; and associating each of the deferral procedures with one or more of the fault codes that were linked, respectively, with the one or more standard repairs to thereby provide a set of associations between deferral procedures and fault codes. The method may be implemented in a software program and the program may advantageously be employed in an aircraft maintenance and operations support system for automatically associating deferral procedures with an aircraft fault model based on historical data.

[redacted]

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L7: Entry 2 of 3 File: USPT Jun 1, 2004

US-PAT-NO: 6745010
DOCUMENT-IDENTIFIER: US 6745010 B2

TITLE: Wireless, frequency-agile spread spectrum ground link-based aircraft data communication system with wireless unit in communication therewith

DATE-ISSUED: June 1, 2004

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Wright; Thomas H.	Indialantic	FL		
Ziarno; James J.	Malabar	FL		

ASSIGNEE-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY	TYPE CODE
Harris Corporation	Melbourne	FL			02

APPL-NO: 10/338426 [PALM]
DATE FILED: January 8, 2003

PARENT-CASE:
RELATED APPLICATIONS This application is a continuation of Ser. No. 09/723,340, filed Nov. 27, 2000, now U.S. Pat. No. 6,522,867, which is a continuation-in-part of Ser. No. 09/474,894 filed on Jun. 2, 1999, now issued U.S. Pat. No. 6,154,637, which is a continuation of Ser. No. 08/557,269, filed Nov. 14, 1995, now issued U.S. Pat. No. 6,047,165.

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US-CL-ISSUED: 455/66.1; 455/67.1, 455/431, 701/14, 701/35, 340/825.69, 340/825.72, 375/219
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FIELD-OF-SEARCH: 455/66, 455/67.1, 455/73, 455/431, 455/66.1, 455/67.11, 340/945, 340/961, 340/971, 340/825.69, 340/539.1, 340/825.72, 340/3.3, 340/3.31, 340/3.32, 375/219, 375/130, 375/200, 375/220, 701/14, 701/35

PRIOR-ART-DISCLOSED:

U.S. PATENT DOCUMENTS

Search Selected Search ALL Clear

PAT-NO	ISSUE-DATE	PATENTEE-NAME	US-CL

☐	4642775	February 1987	Cline et al.	364/443
☐	4729102	March 1988	Miller, Jr. et al.	364/424
☐	4872182	October 1989	McRae et al.	375/1
☐	5022024	June 1991	Paneth et al.	370/50
☐	5339330	August 1994	Mallinckrodt	375/1
☐	5351194	September 1994	Ross et al.	364/449
☐	5359446	October 1994	Johnson et al.	359/152
☐	5445347	August 1995	Ng	236/169
☐	5459469	October 1995	Schuchman et al.	342/37
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☐	5757772	May 1998	Thornberg et al.	370/236
☐	5761625	June 1998	Honcik et al.	701/14
☐	5943399	August 1999	Bannister et al.	379/88.17
☐	6047165	April 2000	Wright et al.	455/66
☐	6181990	January 2001	Grabowsky et al.	701/14
☐	6522867	February 2003	Wright et al.	455/66.1

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FOREIGN-PAT-NO	PUBN-DATE	COUNTRY	CLASS
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2 276 006	September 1994	GB	

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Gate-Aircraft Terminal Environment Link (Gatelink)--Ground Side, ARINC Specification 632, Dec. 30, 1994.
Airlines Electronic Engineering Committee Letter 91-079/DLK-391, Apr. 5, 1991.
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Aviation Week & Space Technology, "Safety Board Urges Mandatory Use of FDR/CVRs in Commuter Transports," Avionics, p. 73, McGraw-Hill, Inc., Aug. 31, 1987.
Aviation Week & Space Technology, "Conversion Approach Appears Flawed," Aerospace Business, vol. 139, No. 4, p. 48, McGraw-Hill, Inc., Jul. 31, 1993.
Electronic Engineering Times,"Module is Result of Work With Apple--Plessey Makes Leap With Wireless LAN," Nov. 7, 1994.

ART-UNIT: 2636

PRIMARY-EXAMINER: Crosland; Donnie L.

ATTY-AGENT-FIRM: Allen, Dyer, Doppelt, Milbrath & Gilchrist, P.A.

ABSTRACT:

A system and method provides a retrievable record of the flight performance of the aircraft and includes a ground data link unit that obtains flight performance data representative of aircraft flight performance during flight of the aircraft. A spread spectrum transceiver is coupled to a data store and operative to download flight performance data that has been accumulated and stored by the data store over a spread spectrum communication signal. A ground base spread spectrum transceiver receives the spread spectrum communication signal from the aircraft and demodulates the signal to obtain flight performance data. A wireless unit is operative with the ground data link unit. This wireless unit could be for inventory control of products during in-flight servicing of passengers.

26 Claims, 18 Drawing figures

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☑ 1. Document ID: US 20050137786 A1

L11: Entry 1 of 2   File: PGPB   Jun 23, 2005

PGPUB-DOCUMENT-NUMBER: 20050137786
PGPUB-FILING-TYPE: new
DOCUMENT-IDENTIFIER: US 20050137786 A1

filed 1/4/05

TITLE: Communication method and arrangement

PUBLICATION-DATE: June 23, 2005

INVENTOR-INFORMATION:

NAME	CITY	STATE	COUNTRY
Breed, David S.	Boonton Township	NJ	US
DuVall, Wilbur E.	Kimberling City	MO	US
Johnson, Wendell C.	Kaneohe	HI	US
Lukin, Kostyantyn Alexandrovich	Kharkov		UA
Konovalov, Vladymyr Michailovich	Kharkov		UA

US-CL-CURRENT: 701/200

Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | Claims | KWIC | Draw D

☐ 2. Document ID: US 20050060069 A1

L11: Entry 2 of 2   File: PGPB   Mar 17, 2005

PGPUB-DOCUMENT-NUMBER: 20050060069
PGPUB-FILING-TYPE: new
DOCUMENT-IDENTIFIER: US 20050060069 A1

TITLE: Method and system for controlling a vehicle

PUBLICATION-DATE: March 17, 2005

INVENTOR-INFORMATION:

NAME	CITY	STATE	COUNTRY
Breed, David S.	Boonton Township	NJ	US
DuVall, Wilbur E.	Kimberling City	MO	US
Johnson, Wendell C.	Kaneohe	HI	US

L9: Entry 1 of 2 File: PGPB Jun 23, 2005

PGPUB-DOCUMENT-NUMBER: 20050137786
PGPUB-FILING-TYPE: new
DOCUMENT-IDENTIFIER: US 20050137786 A1

TITLE: Communication method and arrangement

PUBLICATION-DATE: June 23, 2005

INVENTOR-INFORMATION:

NAME	CITY	STATE	COUNTRY
Breed, David S.	Boonton Township	NJ	US
DuVall, Wilbur E.	Kimberling City	MO	US
Johnson, Wendell C.	Kaneohe	HI	US
Lukin, Kostyantyn Alexandrovich	Kharkov		UA
Konovalov, Vladymyr Michailovich	Kharkov		UA

ASSIGNEE-INFORMATION:

NAME	CITY	STATE	COUNTRY	TYPE CODE
Intelligent Technologies International Inc.				02

APPL-NO: 11/028386 [PALM]
DATE FILED: January 3, 2005

RELATED-US-APPL-DATA:
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parent continuation-in-part-of 10822445 20040412 US PENDING
child 10822445 20040412 US
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parent-patent 6720920 US
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parent continuation-in-part-of 09177041 19981022 US GRANTED
parent-patent 6370475 US
child 10118858
parent continuation-in-part-of 09679317 20001004 US GRANTED
parent-patent 6405132 US
child 09679317 20001004 US
parent continuation-in-part-of 09523559 20000310 US ABANDONED
child 09679317 20001004 US
parent continuation-in-part-of 09177041 19981022 US GRANTED
parent-patent 6370475 US
child 10118858
parent continuation-in-part-of 09909466 20010719 US GRANTED
parent-patent 6526352 US
child 10822445
parent continuation-in-part-of 10216633 20020809 US GRANTED
parent-patent 6768944 US
child 10216633 20020809 US
parent continuation-in-part-of 10118858 20020409 US GRANTED

parent-patent 6720920 US
non-provisional-of-provisional 60062729 19971022 US
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INT-CL: [07] G01 C 21/28

US-CL-PUBLISHED: 701/200
US-CL-CURRENT: 701/200

REPRESENTATIVE-FIGURES: 4

ABSTRACT:

Arrangement for transferring information between a vehicle and one or more transmitters separate from the vehicle includes an antenna mounted on the vehicle and capable of receiving radio frequency waves emitted by the transmitter and containing information, a position determining device for determining the position of the vehicle, and a processor coupled to the antenna and the position determining device and arranged to analyze the waves received by the antenna, determine whether any received waves contain information of interest for operation of the vehicle based on the vehicle's position as determined by the position determining device, and extract the information of interest only from the received waves determined to contain information of interest. The information of interest may be information about the transmitter such as its location, speed, velocity, etc., or information relating to road conditions, weather and the like.

CROSS REFERENCE TO RELATED APPLICATIONS

[0001] This application is a continuation-in-part of U.S. patent application Ser. No. 10/822,445 filed Apr. 12, 2004 which is a continuation-in-part of:

[0002] 1) U.S. patent application Ser. No. 10/118,858 filed Apr. 9, 2002, now U.S. Pat. No. 6,720,920, which is:

[0003] A) a continuation-in-part of U.S. patent application Ser. No. 09/177,041 filed Oct. 22, 1998, now U.S. Pat. No. 6,370,475, which claims priority under 35 U.S.C. .sctn.119(e) of U.S. provisional patent application Ser. No. 60/062,729 filed Oct. 22, 1997;

[0004] B) a continuation-in-part of U.S. patent application Ser. No. 09/679,317 filed Oct. 4, 2000, now U.S. Pat. No. 6,405,132, which is a continuation-in-part of:

[0005] a) U.S. patent application Ser. No. 09/523,559 filed Mar. 10, 2000, now abandoned, which claims priority under 35 U.S.C. .sctn.119(e) of U.S. provisional patent application Ser. No. 60/123,882 filed Mar. 11, 1999, and which is a continuation-in-part of U.S. patent application Ser. No. 09/177,041 filed Oct. 22, 1998, now U.S. Pat. No. 6,370,475, which claims priority under 35 U.S.C. .sctn.119 (e) of U.S. provisional patent application Ser. No. 60/062,729 filed Oct. 22, 1997; and

[0006] C) U.S. patent application Ser. No. 09/909,466 filed Jul. 19, 2001, now U.S. Pat. No. 6,526,352; and

[0007] 2) U.S. patent application Ser. No. 10/216,633 filed Aug. 9, 2002, now U.S.

Pat. No. 6,768,944, which is a continuation-in-part of U.S. patent application Ser. No. 10/118,858 filed Apr. 9, 2002.

[0008] All of the above applications are incorporated by reference herein.

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L11: Entry 1 of 2 File: PGPB Jun 23, 2005

DOCUMENT-IDENTIFIER: US 20050137786 A1
TITLE: Communication method and arrangement

Pre-Grant Publication (PGPub) Document Number:
20050137786

Summary of Invention Paragraph:
[0039] "Pattern recognition" as used herein will generally mean any system which processes a signal that is generated by an object (e.g., representative of a pattern of returned or received impulses, waves or other physical property specific to and/or characteristic of and/or representative of that object) or is modified by interacting with an object, in order to determine to which one of a set of classes that the object belongs. Such a system might determine only that the object is or is not a member of one specified class, or it might attempt to assign the object to one of a larger set of specified classes, or find that it is not a member of any of the classes in the set. The signals processed are generally a series of electrical signals coming from transducers that are sensitive to acoustic (ultrasonic) or electromagnetic radiation (e.g., visible light, infrared radiation, capacitance or electric and/or magnetic fields), although other sources of information are frequently included. Pattern recognition systems generally involve the creation of a set of rules that permit the pattern to be recognized. These rules can be created by fuzzy logic systems, statistical correlations, or through sensor fusion methodologies as well as by trained pattern recognition systems such as neural networks, combination neural networks, cellular neural networks or support vector machines.

Summary of Invention Paragraph:
[0040] "Neural network" as used herein, unless stated otherwise, will generally mean a single neural network, a combination neural network, a cellular neural network, a support vector machine or any combinations thereof. For the purposes herein, a "neural network" is defined to include all such learning systems including cellular neural networks, support vector machines and other kernel-based learning systems and methods, cellular automata and all other pattern recognition methods and systems that learn. A "combination neural network" as used herein will generally apply to any combination of two or more neural networks as most broadly defined that are either connected together or that analyze all or a portion of the input data.

Summary of Invention Paragraph:
[0041] A trainable or a trained pattern recognition system as used herein generally means a pattern recognition system that is taught to recognize various patterns constituted within the signals by subjecting the system to a variety of examples. The most successful such system is the neural network used either singly or as a combination of neural networks. Thus, to generate the pattern recognition algorithm, test data is first obtained which constitutes a plurality of sets of returned waves, or wave patterns, or other information radiated or obtained from an object (or from the space in which the object will be situated in the passenger compartment, i.e., the space above the seat) and an indication of the identify of that object. A number of different objects are tested to obtain the unique patterns from each object. As such, the algorithm is generated, and stored in a computer

processor, and which can later be applied to provide the identity of an object based on the wave pattern being received during use by a receiver connected to the processor and other information. For the purposes here, the identity of an object sometimes applies to not only the object itself but also to its location and/or orientation and velocity in the vicinity of the vehicle. For example, a vehicle that is stopped but pointing at the side of the host vehicle is different from the same vehicle that is approaching at such a velocity as to impact the host vehicle. Not all pattern recognition systems are trained systems and not all trained systems are neural networks. Other pattern recognition systems are based on fuzzy logic, sensor fusion, Kalman filters, correlation as well as linear and non-linear regression. Still other pattern recognition systems are hybrids of more than one system such as neural-fuzzy systems.

Summary of Invention Paragraph:
[0042] The use of pattern recognition, or more particularly how it is used, is important to the instant invention. In the above-cited prior art, except in that assigned to the current assignee, pattern recognition which is based on training, as exemplified through the use of neural networks, is not mentioned for use in monitoring the interior passenger compartment or exterior environments of the vehicle in all of the aspects of the invention disclosed herein. Thus, the methods used to adapt such systems to a vehicle are also not mentioned.

Summary of Invention Paragraph:
[0043] A pattern recognition algorithm will thus generally mean an algorithm applying or obtained using any type of pattern recognition system, e.g., a neural network, sensor fusion, fuzzy logic, etc.

Summary of Invention Paragraph:
[0052] "Adaptation" as used here will generally represent the method by which a particular occupant or vehicle or other object sensing system is designed and arranged for a particular vehicle model. It includes such things as the process by which the number, kind and location of various transducers is determined. For pattern recognition systems, it includes the process by which the pattern recognition system is designed and then taught or made to recognize the desired patterns. In this connection, it will usually include (1) the method of training when training is used, (2) the makeup of the databases used, testing and validating the particular system, or, in the case of a neural network, the particular network architecture chosen, (3) the process by which environmental influences are incorporated into the system, and (4) any process for determining the pre-processing of the data or the post processing of the results of the pattern recognition system. The above list is illustrative and not exhaustive. Basically, adaptation includes all of the steps that are undertaken to adapt transducers and other sources of information to a particular vehicle to create the system that accurately identifies and/or determines the location of an occupant or other object in a vehicle or in the environment around the vehicle.

Detail Description Paragraph:
[0159] For all cases where vehicle steering control is assumed by the RtZF.TM. system, an algorithm for controlling the steering should be developed using neural networks or neural fuzzy systems. This is especially true for the emergency cases discussed herein where it is well known that operators frequently take the wrong actions and at the least they are slow to react. Algorithms developed by other non-pattern recognition techniques do not in general have the requisite generality or complexity and are also likely to make the wrong decisions (although the use of such systems is not precluded in the invention). When the throttle and breaking functions are also handled by the system, an algorithm based on neural networks or neural fuzzy systems is even more important.

Detail Description Paragraph:
[0290] Infrared and terahertz also have sufficient resolution so that pattern

recognition technologies can be employed to recognize various objects, such as vehicles, in the reflected image as discussed above. Infrared has another advantage from the object recognition perspective. All objects radiate and reflect infrared. The hot engine or tires of a moving vehicle in particular are recognizable signals. Thus, if the area around a vehicle is observed with both passive and active infrared, more information can be obtained than from radar, for example. Infrared is less attenuated by fog than optical frequencies, although it is not as good as radar. Infrared is also attenuated by snow but at the proper frequencies it has about five times the range of human sight. Terahertz under some situations has an effective range of as much as several hundred times that of human sight. Note, as with radar, Infrared and terahertz can be modulated with noise, pseudonoise, or other distinctive signal to permit the separation of various reflected signals from different transmitting vehicles.

Detail Description Paragraph:
[0297] The laser radar scanner can be set up in conjunction with a range gate so that once it finds a object, the range can be narrowed so that only that object and other objects at the same range, 65 to 75 feet for example, are allowed to pass to the receiver. In this way, an image of a vehicle can be separated from the rest of the scene for identification by pattern recognition software. Once the image of the particular object has been captured, the range gate is broadened, to about 20 to 500 feet for example, and the process repeated for another object. In this manner, all objects in the field of interest to the vehicle can be separated and individually imaged and identified. Alternately, a scheme based on velocity can be used to separate a part of one object from the background or from other objects. The field of interest, of course, is the field where all objects with which the vehicle can potentially collide reside. Particular known and mapped features on the highway can be used as aids to the scanning system so that the pitch and perhaps roll angles of the vehicle can be taken into account.

Detail Description Paragraph:
[0301] Other methods of associating a distance to a particular reflection point,.of course, can now be conceived by those skilled in the art including variations of the above ideas using a pixel mixing device or variations in pixel illumination and shutter open time to determine distance through comparison of range gated received reflected light. In the laser scanning cases, the total power required from the laser is significantly less than in the area illumination design. However, the ability to correctly change the direction of the laser beam in a sufficiently short period of time complicates the scanning design. The system would work approximately as follows: The entire area in front of the instant vehicle, perhaps as much as a full 180 degree arc in the horizontal plane would be scanned for objects using either radar or laser radar. Once one or more objects had been located, the scanning range would be severely limited to basically cover that particular object and some surrounding space using laser radar. Based on the range to that object, a range gate can be used to eliminate all background and perhaps interference from other objects. In this manner, a very clear picture or image of the object of interest can be obtained as well as its location and, through the use of a neural network pattern of recognition system, the identity of the object can be ascertained as to whether it is a sign, a truck, an animal, a person, an automobile or other object. The identification of the object will permit an estimate to be made of the object's mass and thus the severity of any potential collision.

Detail Description Paragraph:
[0502] Although the neural network 63 has in particular been described above and will be described in more detail below, other pattern recognition techniques are also applicable. One such technique uses the Fourier transform of the image and utilizes either optical correlation techniques or a neural network trained on the Fourier transforms of the images rather than on the image itself In one case, the optical correlation is accomplished purely optically wherein the Fourier transform of the image is accomplished using diffraction techniques and projected onto a

display, such as a garnet crystal display, while a library of the object Fourier transforms is also displayed on the display. By comparing the total light passing through the display, an optical correlation can be obtained very rapidly. Although such a technique has been applied to scene scanning by military helicopters, it has heretofore not been used in automotive applications.

Detail Description Paragraph:
[0556] In sum, disclosed above is a computer controlled vehicle and obstacle location system and method which includes the steps of receiving continuously from a network of satellites on a first communication link at one of a plurality of vehicles, GPS ranging signals for initially accurately determining, in conjunction with centimeter accurate maps, the host vehicle's position on a roadway on a surface of the earth; receiving continuously at the host vehicle on a second communication link from a station, another vehicle or satellite, DGPS auxiliary range correction signals for correcting propagation delay errors in the GPS ranging signals; determining continuously at the host vehicle from the GPS, DGPS, and accurate map database signals host vehicle's position on the surface of the earth with centimeter accuracy; communicating the host vehicle's position to another one of the plurality of vehicles, and receiving at the host vehicle, location information from at least one of a plurality of other vehicles; determining whether the other vehicle represents a collision threat to the host vehicle based on its position relative to the roadway and the host vehicle and generating a warning or vehicle control signal response to control the vehicles motion laterally or longitudinally to prevent a collision with the other vehicle. In some implementations, the detecting step includes detecting objects by scanning with one or more cameras, radars or laser radars located on the host vehicle. The analyzing step includes processing and analyzing digital signals indicative of video images detected by the one or more cameras, radars or laser radars, and processing and analyzing the digital signals using pattern recognition and range determination algorithms. The objects detected may include fixed or moving, or known or unknown obstacles, people, bicycles, animals, or the like.

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L11: Entry 2 of 2 File: PGPB Mar 17, 2005

DOCUMENT-IDENTIFIER: US 20050060069 A1
TITLE: Method and system for controlling a vehicle

Pre-Grant Publication (PGPub) Document Number:
20050060069

Summary of Invention Paragraph:
[0050] Since many of the concepts disclosed in the inventions herein make use of neural networks, a background of neural networks is important to the reader. The theory of neural networks including many examples can be found in several books on the subject including: (1) Techniques and Application of Neural Networks, edited by Taylor, M. and Lisboa, P., Ellis Horwood, West Sussex, England, 1993; (2) Naturally Intelligent Systems, by Caudill, M. and Butler, C., MIT Press, Cambridge Mass., 1990; (3) J. M. Zaruda, Introduction to Artificial Neural Systems, West publishing Co., N.Y., 1992, (4) Digital Neural Networks, by Kung, S. Y., PTR Prentice Hall, Englewood Cliffs, N.J., 1993, Eberhart, R., Simpson, P., (5) Dobbins, R., Computational Intelligence PC Tools, Academic Press, Inc., 1996, Orlando, Fla., (6) Cristianini, N. and Shawe-Taylor, J. An Introduction to Support Vector Machines and Other Kernel-Based Learning Methods, Cambridge University Press, Cambridge England, 2000; (7) Proceedings of the 2000 6.sup.th IEEE International Workshop on Cellular Neural Networks and their Applications (CNNA 2000), IEEE, Piscataway N.J.; and (8) Sinha, N. K. and Gupta, M. M. Soft Computing & Intelligent Systems, Academic Press 2000 San Diego, Calif. The neural network pattern recognition technology is one of the most developed of pattern recognition technologies. The invention described herein uses combinations of neural networks to improve the pattern recognition process.

Summary of Invention Paragraph:
[0172] Although, there appears not to be any significant prior art involving a vehicle communicating safety information to another vehicle on the roadway, several patents discuss methods of determining that a collision might take place using infrared and radar. U.S. Pat. No. 5,249,128 to Markandey et al., for example, discusses methods of using infrared to determine the distance to a vehicle in front and U.S. Pat. No. 5,506,584 to Boles describes a radar-based system. Both systems suffer from a high false alarm rate and could be substantially improved if a pattern recognition system such as neural networks were used. Also, neither system makes use of noise modulation technologies as taught herein.

Summary of Invention Paragraph:
[0240] "Pattern recognition" as used herein will generally mean any system which processes a signal that is generated by an object (e.g., representative of a pattern of returned or received impulses, waves or other physical property specific to and/or characteristic of and/or representative of that object) or is modified by interacting with an object, in order to determine to which one of a set of classes that the object belongs. Such a system might determine only that the object is or is not a member of one specified class, or it might attempt to assign the object to one of a larger set of specified classes, or find that it is not a member of any of the classes in the set. The signals processed are generally a series of electrical

signals coming from transducers that are sensitive to acoustic (ultrasonic) or electromagnetic radiation (e.g., visible light, infrared radiation, capacitance or electric and/or magnetic fields), although other sources of information are frequently included. Pattern recognition systems generally involve the creation of a set of rules that permit the pattern to be recognized. These rules can be created by fuzzy logic systems, statistical correlations, or through sensor fusion methodologies as well as by trained pattern recognition systems such as neural networks, combination neural networks, cellular neural networks or support vector machines.

Summary of Invention Paragraph:
[0241] "Neural network" as used herein, unless stated otherwise, will generally mean a single neural network, a combination neural network, a cellular neural network, a support vector machine or any combinations thereof. For the purposes herein, a "neural network" is defined to include all such learning systems including cellular neural networks, support vector machines and other kernel-based learning systems and methods, cellular automata and all other pattern recognition methods and systems that learn. A "combination neural network" as used herein will generally apply to any combination of two or more neural networks as most broadly defined that are either connected together or that analyze all or a portion of the input data.

Summary of Invention Paragraph:
[0242] A trainable or a trained pattern recognition system as used herein generally means a pattern recognition system that is taught to recognize various patterns constituted within the signals by subjecting the system to a variety of examples. The most successful such system is the neural network used either singly or as a combination of neural networks. Thus, to generate the pattern recognition algorithm, test data is first obtained which constitutes a plurality of sets of returned waves, or wave patterns, or other information radiated or obtained from an object (or from the space in which the object will be situated in the passenger compartment, i.e., the space above the seat) and an indication of the identify of that object. A number of different objects are tested to obtain the unique patterns from each object. As such, the algorithm is generated, and stored in a computer processor, and which can later be applied to provide the identity of an object based on the wave pattern being received during use by a receiver connected to the processor and other information. For the purposes here, the identity of an object sometimes applies to not only the object itself but also to its location and/or orientation and velocity in the vicinity of the vehicle. For example, a vehicle that is stopped but pointing at the side of the host vehicle is different from the same vehicle that is approaching at such a velocity as to impact the host vehicle. Not all pattern recognition systems are trained systems and not all trained systems are neural networks. Other pattern recognition systems are based on fuzzy logic, sensor fusion, Kalman filters, correlation as well as linear and non-linear regression. Still other pattern recognition systems are hybrids of more than one system such as neural-fuzzy systems.

Summary of Invention Paragraph:
[0243] The use of pattern recognition, or more particularly how it is used, is important to the instant invention. In the above-cited prior art, except in that assigned to the current assignee, pattern recognition which is based on training, as exemplified through the use of neural networks, is not mentioned for use in monitoring the interior passenger compartment or exterior environments of the vehicle in all of the aspects of the invention disclosed herein. Thus, the methods used to adapt such systems to a vehicle are also not mentioned.

Summary of Invention Paragraph:
[0244] A pattern recognition algorithm will thus generally mean an algorithm applying or obtained using any type of pattern recognition system, e.g., a neural network, sensor fusion, fuzzy logic, etc.

Summary of Invention Paragraph:
[0253] "Adaptation" as used here will generally represent the method by which a particular occupant or vehicle or other object sensing system is designed and arranged for a particular vehicle model. It includes such things as the process by which the number, kind and location of various transducers is determined. For pattern recognition systems, it includes the process by which the pattern recognition system is designed and then taught or made to recognize the desired patterns. In this connection, it will usually include (1) the method of training when training is used, (2) the makeup of the databases used, testing and validating the particular system, or, in the case of a neural network, the particular network architecture chosen, (3) the process by which environmental influences are incorporated into the system, and (4) any process for determining the pre-processing of the data or the post processing of the results of the pattern recognition system. The above list is illustrative and not exhaustive. Basically, adaptation includes all of the steps that are undertaken to adapt transducers and other sources of information to a particular vehicle to create the system that accurately identifies and/or determines the location of an occupant or other object in a vehicle or in the environment around the vehicle.

Detail Description Paragraph:
[0340] For all cases where vehicle steering control is assumed by the RtZF.TM. system, an algorithm for controlling the steering should be developed using neural networks or neural fuzzy systems. This is especially true for the emergency cases discussed herein where it is well known that operators frequently take the wrong actions and at the least they are slow to react. Algorithms developed by other non-pattern recognition techniques do not in general have the requisite generality or complexity and are also likely to make the wrong decisions (although the use of such systems is not precluded in the invention). When the throttle and breaking functions are also handled by the system, an algorithm based on neural networks or neural fuzzy systems is even more important.

Detail Description Paragraph:
[0469] Infrared and terahertz also have sufficient resolution so that pattern recognition technologies can be employed to recognize various objects, such as vehicles, in the reflected image as discussed above. Infrared has another advantage from the object recognition perspective. All objects radiate and reflect infrared. The hot engine or tires of a moving vehicle in particular are recognizable signals. Thus, if the area around a vehicle is observed with both passive and active infrared, more information can be obtained than from radar, for example. Infrared is less attenuated by fog than optical frequencies, although it is not as good as radar. Infrared is also attenuated by snow but at the proper frequencies it has about five times the range of human sight. Terahertz under some situations has an effective range of as much as several hundred times that of human sight. Note, as with radar, Infrared and terahertz can be modulated with noise, pseudonoise, or other distinctive signal to permit the separation of various reflected signals from different transmitting vehicles.

Detail Description Paragraph:
[0476] The laser radar scanner can be set up in conjunction with a range gate so that once it finds a object, the range can be narrowed so that only that object and other objects at the same range, 65 to 75 feet for example, are allowed to pass to the receiver. In this way, an image of a vehicle can be separated from the rest of the scene for identification by pattern recognition software. Once the image of the particular object has been captured, the range gate is broadened, to about 20 to 500 feet for example, and the process repeated for another object. In this manner, all objects in the field of interest to the vehicle can be separated and individually imaged and identified. Alternately, a scheme based on velocity can be used to separate a part of one object from the background or from other objects. The field of interest, of course, is the field where all objects with which the

vehicle can potentially collide reside. Particular known and mapped features on the highway can be used as aids to the scanning system so that the pitch and perhaps roll angles of the vehicle can be taken into account.

Detail Description Paragraph:
[0480] Other methods of associating a distance to a particular reflection point, of course, can now be conceived by those skilled in the art including variations of the above ideas using a pixel mixing device or variations in pixel illumination and shutter open time to determine distance through comparison of range gated received reflected light. In the laser scanning cases, the total power required from the laser is significantly less than in the area illumination design. However, the ability to correctly change the direction of the laser beam in a sufficiently short period of time complicates the scanning design. The system would work approximately as follows: The entire area in front of the instant vehicle, perhaps as much as a full 180 degree arc in the horizontal plane would be scanned for objects using either radar or laser radar. Once one or more objects had been located, the scanning range would be severely limited to basically cover that particular object and some surrounding space using laser radar. Based on the range to that object, a range gate can be used to eliminate all background and perhaps interference from other objects. In this manner, a very clear picture or image of the object of interest can be obtained as well as its location and, through the use of a neural network pattern of recognition system, the identity of the object can be ascertained as to whether it is a sign, a truck, an animal, a person, an automobile or other object. The identification of the object will permit an estimate to be made of the object's mass and thus the severity of any potential collision.

Detail Description Paragraph:
[0681] Although the neural network 63 has in particular been described above and will be described in more detail below, other pattern recognition techniques are also applicable. One such technique uses the Fourier transform of the image and utilizes either optical correlation techniques or a neural network trained on the Fourier transforms of the images rather than on the image itself. In one case, the optical correlation is accomplished purely optically wherein the Fourier transform of the image is accomplished using diffraction techniques and projected onto a display, such as a garnet crystal display, while a library of the object Fourier transforms is also displayed on the display. By comparing the total light passing through the display, an optical correlation can be obtained very rapidly. Although such a technique has been applied to scene scanning by military helicopters, it has heretofore not been used in automotive applications.

Detail Description Paragraph:
[0735] In sum, disclosed above is a computer controlled vehicle and obstacle location system and method which includes the steps of receiving continuously from a network of satellites on a first communication link at one of a plurality of vehicles, GPS ranging signals for initially accurately determining, in conjunction with centimeter accurate maps, the host vehicle's position on a roadway on a surface of the earth; receiving continuously at the host vehicle on a second communication link from a station, another vehicle or satellite, DGPS auxiliary range correction signals for correcting propagation delay errors in the GPS ranging signals; determining continuously at the host vehicle from the GPS, DGPS, and accurate map database signals host vehicle's position on the surface of the earth with centimeter accuracy; communicating the host vehicle's position to another one of the plurality of vehicles, and receiving at the host vehicle, location information from at least one of a plurality of other vehicles; determining whether the other vehicle represents a collision threat to the host vehicle based on its position relative to the roadway and the host vehicle and generating a warning or vehicle control signal response to control the vehicles motion laterally or longitudinally to prevent a collision with the other vehicle. In some implementations, the detecting step includes detecting objects by scanning with one or more cameras, radars or laser radars located on the host vehicle. The analyzing

step includes processing and analyzing digital signals indicative of video images detected by the one or more cameras, radars or laser radars, and processing and analyzing the digital signals using pattern recognition and range determination algorithms. The objects detected may include fixed or moving, or known or unknown obstacles, people, bicycles, animals, or the like.

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DOCUMENT-IDENTIFIER: US 20050125148 A1
TITLE: Prediction of vehicle operator destinations

Abstract Paragraph:
A method for predicting vehicle operator destinations including receiving vehicle position data for a vehicle. The vehicle position data for a current trip is compared to vehicle position data for a previous trip to predict a destination for the vehicle. A path to the destination is suggested.

Current US Classification, US Primary Class/Subclass:
701/209

Summary of Invention Paragraph:
[0001] The present disclosure relates generally to the prediction of vehicle operator destinations and in particular, to a method of suggesting the likely path of a vehicle based on previous paths taken by the vehicle operator.

Summary of Invention Paragraph:
[0002] In recent years, navigation systems mounted in vehicles for displaying a map to vehicle operators have become more common. Most navigation systems include a device, such as a global positioning system (GPS) receiver, for determining the exact location of a vehicle. GPS refers to a collection of satellites owned by the United States Government that provide highly accurate, worldwide positioning and navigation information twenty-four hours per day. An increasing number of affordable GPS receivers are being manufactured for consumer as well as non-consumer use. GPS receivers are continuing to become less expensive, smaller in size and able to support more features. Many of the vehicle navigation systems that are currently being manufactured include GPS receivers.

Summary of Invention Paragraph:
[0003] A destination point for a vehicle is typically set in a navigation system by a vehicle operator or by a passenger using a remote control device or the like. The setting of the destination point can be based on items such as: the name of a town or region; a telephone number; or a pre-selected geographical point from a list of pre-registered geographical points. Current navigation systems require the use of a map to determine routes and to perform navigation functions. A typical navigation system includes a database or access to a database that contains streets and other geographical landmarks. These streets and other geographical landmarks are correlated to GPS coordinates received via a GPS receiver in order to determine the physical location of a vehicle in terms of map locations.

Summary of Invention Paragraph:
[0005] An exemplary embodiment of the present invention includes a method for predicting vehicle operator destinations. Vehicle position data for a vehicle is received. The vehicle position data for a current trip is compared to vehicle position data for a previous trip to predict a destination for the vehicle. A path to the destination is suggested.

Summary of Invention Paragraph:
[0006] In a further aspect, a system for predicting vehicle operator destinations

includes a navigation device, a storage device, and a microprocessor in communication with the navigation device and the storage device. The microprocessor includes instructions to implement a method including receiving vehicle position data for a vehicle via said navigation device. The vehicle position data for a current trip is compared to vehicle position data for a previous trip to predict a destination for the vehicle. The vehicle position data for a previous trip is stored in the database. A path to the destination is suggested.

Summary of Invention Paragraph:
[0007] In still another aspect, a computer program product for predicting vehicle operator destinations includes a storage medium readable by a processing circuit and storing instructions for execution by the processing circuit for performing a method. The method includes receiving vehicle position data for a vehicle. The vehicle position data for a current trip is compared to vehicle position data for a previous trip to predict a destination for the vehicle. A path to the destination is suggested.

Detail Description Paragraph:
[0014] An exemplary embodiment of the present invention is a knowledge-based software system that converts raw vehicle operator contextual information (e.g., GPS data) to knowledge (e.g., rules and facts) about a vehicle operator's driving behavior. Learning techniques are utilized to predict the vehicle operator's route and destination in real-time based on continuous GPS feeds and knowledge of the vehicle operator's previous behavior while driving. In addition, an exemplary embodiment of the present invention may be utilized to automatically generate a vehicle operator's driving behavior profile that can be used by telematics services (e.g., navigation, travel, car maintenance).

Detail Description Paragraph:
[0015] The developed knowledge-based software system consists of a set of operations including fuzzy or approximate tests of time of day, day of week, positions and paths made up of a series of positions. The approximations in the tests manage the variability in actual and apparent vehicle operator behavior caused by limitations on the precision and repeatability of the position reporting device and variations in the vehicle operator, traffic and parking from day to day. The rules or decision procedures control the segmentation of travel into individual trips (e.g., based on an extended layover at a position), compiling sets of similar trips into idioms used by a vehicle operator, making and revising predictions of likely vehicle operator behavior by matching these idioms with the trip in process, and combining these predictions with information from external sources. The external sources may include vehicle telematics (e.g., need for fuel or service), contact and appointment data from electronic organizers, traffic information services, and service directories.

Detail Description Paragraph:
[0016] In an exemplary embodiment of the present invention, vehicle operators' driving behavior profiles are created automatically based solely on the navigation data, without utilizing any map or geo-coding databases/services to convert position data into street addresses. This is performed by utilizing position reporting systems (e.g., GPS) that provide accuracy and repeatability more granular than the typical spacing between streets. One advantage this approach offers is that it does not require a local road database. A local road database typically requires a large amount of storage space, becomes less accurate over the service life of a vehicle as roads change and often omits private roads. Another advantage to this approach is that it does not require continuous access to a database service. This may result in a significant cost savings in terms of wireless access fees and database access fees.

Detail Description Paragraph:
[0017] FIG. 1 is a block diagram of an exemplary system for predicting vehicle

operator driving patterns that includes both hardware and software components contained within a vehicle 102. One hardware component is a navigation device 104 (e.g., a GPS receiver) for continuously determining position, heading and speed of the vehicle 102. Another hardware component is a computing device 106 (e.g., a microprocessor) to perform learning and reasoning. The computing device 106 includes access to persistent storage 108. The persistent storage 108 may be implemented using any storage device known in art such as non-volatile memory in the computing device 106 or a small disk drive accessible by the computing device 106.

Detail Description Paragraph:
[0018] The software components shown in FIG. 1 include a learning engine 110, a set of conflict resolution and prediction rules 112 and a database 114. The system collects data from a GPS navigation device 104 while the vehicle is being driven and matches the data with previously collected data to make a prediction of the operator's future destinations in real-time using the conflict resolution and prediction rules 112. Consequently, with the ability to anticipate the operator's next move, the system provides information that may align with the vehicle operator's needs (e.g., gasoline, hotels) and may coordinate with providers of external conditions to help the operator improve the driving condition (e.g., avoid traffic congestion, avoid inclement weather). Gradually, a database 114 that describes vehicle operator behaviors and preferences is incrementally derived from the learning engine 110.

Detail Description Paragraph:
[0019] The navigation device 104 may include any device known in the art for providing position data such as a GPS device or an inertial navigation device. Currently, a GPS device may provide the most cost-effective source of adequate position information, but rapid progress in micro electro mechanical systems (MEMS) technology may lead to a low cost inertial navigational alternative in the near future. Both approaches have their advantages and disadvantages. For example: GPS may lose reception of satellites blocked by terrain, buildings and weather; and MEMS may experience drift from an accumulation of measurement errors.

Detail Description Paragraph:
[0020] The navigation device 104 may either present reports automatically based on time and/or movement or by being polled regularly. The frequency of reporting has to be high enough to recognize vehicle stops and turns. In an exemplary embodiment of the present invention being utilized for a typical automobile application using GPS as the navigation device 104, position reports in the range of five to one hundred meters of change in position and in the range of one second for a moving vehicle are utilized. Smaller changes in position are both beyond the limitations of GPS and may be finer than required for general planning and navigation. One second at normal driving speed is not more than thirty to forty meters, and less at sharp turns when closer position reports are most useful. Accuracy and repeatability need to be sufficient to distinguish position to the nearest roadway. Individual roads are typically from three to thirty meters wide and rarely spaced closer than thirty meters.

Detail Description Paragraph:
[0022] FIG. 2 is a block diagram of exemplary software components for predicting vehicle operator driving patterns. The learning engine 106 receives (e.g., every few seconds, when the vehicle location changes) a series of reports 204 from the GPS navigation device 104. Any navigation device 104 that can provide location information may be utilized by exemplary embodiments of the present invention (e.g., GPS receiver, inertial navigation device). Each report 204 from the GPS navigation device 104 includes a position that may be expressed as latitude and longitude, and a timestamp. In addition, the report 204 may include speed and direction. While speed and direction can be estimated by comparison to the preceding position report 204, a more accurate estimate may be available from the

GPS navigation device 104. The learning engine 106 collects and segments the individual positions into individual trips for discovering patterns of similar trips. The output of the learning engine 106 is a set of high-level messages such as start of trip, end of trip and reports of patterns. The learning engine may be rules-based and implemented utilizing any tool for building expert systems such as C Language Integrated Production System (CLIPS) or Java Expert Shell System (JESS).

Detail Description Paragraph:
[0023] Still referring to FIG. 2, the conflict resolution and prediction rules 112 maintain the driver behavior model database 208 including the rules and facts. The conflict resolution and prediction rules 112 may be executed in an expert system environment (e.g., CLIPS, JESS) and initiated by the learning engine 106. In an exemplary embodiment of the present invention, the driver behavior model database 208 is located in or accessed via the persistent storage 108. The conflict resolution and prediction rules 112 also provide feedback, via the feedback loop 210 to the vehicle operator 212. This feedback may be advice to the vehicle operator 212 such as how to avoid traffic to a predicted destination. Alternatively, the feedback loop 210 may seek guidance from the vehicle operator when different predictions lead to different advice. In addition, the persistent storage 108 may be utilized to store the vehicle operator's driving history, observed patterns, rules, and data downloaded from electronic organizers (e.g., appointments and contact information).

Detail Description Paragraph:
[0024] One of the conflict resolution and prediction rules 112 implemented by the learning engine 106 computes the following numeric values summarizing the differences between two paths. It may be utilized to determine if the current path is different from previous paths. Each path consists of a list of coordinates from the navigation device 104 (e.g., latitude and longitude). The driver behaviors model database 208 stores a copy of each path and statistics associated with each path (e.g., time of day, day of week). In an exemplary embodiment of the present invention, results of the comparison between two paths includes:

Detail Description Paragraph:
[0025] The distance along the beginning of one path that does not match the other path;

Detail Description Paragraph:
[0026] The distance at the end of one of the paths that does not match the other path, this may be the same path or the other path;

Detail Description Paragraph:
[0027] The distance along the first path that is considered to run roughly parallel to the other path;

Detail Description Paragraph:
[0028] The area between the two paths along this parallel distance;

Detail Description Paragraph:
[0029] The mean distance between these parallel paths, computed as the above area divided by the parallel distance; and

Detail Description Paragraph:
[0030] The coordinates of the first point (if any) where the paths move substantially apart.

Detail Description Paragraph:
[0031] In an exemplary embodiment of the present invention, the above procedure may be written in Java or C to handle the many cases as the segments of the path cross

or make transitions between segments. Even when two paths are generated from the record of two identical trips in the vehicle, the points recorded will vary between paths due to limitations on the precision and repeatability of the navigation device 104 and variations in speed due to the flow of traffic.

Detail Description Paragraph:
[0032] FIG. 3 is a graphical representation of an exemplary vehicle operator driving pattern including multiple paths and corresponding statistics. It represents the type of information that can be learned by the learning engine 106 utilizing an exemplary embodiment of the present invention, and thus may be predicted. The lines represent plots of the coordinate sequence for a route, the circles are locations 302 that represent start and end points for trips. The labels 304 along the routes are the information that would be averaged to characterize a trip. For example, the top line from the starting location 302 labeled "work" to the ending location 302 labeled "home" represents a trip on six different weekday evenings, with an average departure time of 5:45 p.m. and an average duration of forty-seven minutes. The labels on the locations 302 are for convenience in discussing FIG. 3, they are not required for predicting vehicle operator driving patterns utilizing an exemplary embodiment of the present invention. In some cases, such labels may be derived automatically by consulting a geographic database or coordinating with the vehicle operator's appointment book. A few locations 302 such as home and work may be guessed based on being the start and end points for the largest number of trips. The graph depicted in FIG. 3 is meant to be a sample of a subset of the kind of data that may be collected by the learning engine 106 for a particular vehicle operator.

Detail Description Paragraph:
[0033] As described previously, the conflict resolution and prediction rules 112 control the segmentation of travel into individual trips (e.g., based on extended layover at a position), compiling sets of similar trips into idioms used by a vehicle operator, making and revising predictions of likely vehicle operator behavior by matching these idioms with the trip in progress and combing these predictions with information from external sources.

Detail Description Paragraph:
[0034] Trip segmentation rules may be simplified if information from the vehicle 102 is available indicating whether the vehicle 102 is running or not. In this case, turning on the vehicle 102 signals the start of a trip and turning it off signals the completion. When this information is not available, it may be derived from watching the reports from the navigation device 104. Whenever approximately the same location and near zero velocity is reported for more than a few minutes, it can be presumed that the vehicle 102 is between trips. Some additional processing is required to manage anomalies where the navigation device 104 cannot report position because power is removed when the vehicle 102 is off or located inside a structure that blocks GPS signals. Immediately following such conditions, there may be some additional delay while the navigation device 104 reinitializes (e.g., reacquires satellites). In this case, additional rules will be utilized to estimate corrections to the start of a new trip. The final output of these rules is a record of every trip made in the vehicle 102. For each trip, the starting and ending date, time and position are recorded, along with a record of the path followed, as depicted in the example shown in FIG. 3.

Detail Description Paragraph:
[0035] The record of a path may be either a record of every location reported, in order, from the navigation device 104, or alternatively, a condensed abstract. An effective abstract may be derived from the complete record by omitting points that can be adequately interpolated between the remaining points. The exact threshold may vary depending on the application, but it in an exemplary embodiment of the present invention it is as large as common road widths, slightly larger than navigation errors, but smaller than the distance between most parallel roads. In an

exemplary embodiment of the present invention utilizing a GPS navigation device 104, the threshold is about fifty meters. Since many streets and roads contain long, straight segments, the segments between turns can be substantially compressed. This compression can result in cost savings due to using less persistent storage 108.

Detail Description Paragraph:
[0036] Creating the rules that recognize driving patterns may be performed by comparing the locations of the end points, the paths taken, the time of day, and the duration of the trip. All of these comparisons allow for some inexactness of the matches that result from the precision of the navigation device 104, moderate variation in traffic and human variation. Trips that match are collected into aggregated descriptions that represent the typical trip and some indication of the range of variation in the parameters. Additional matches can be recognized based on trips that relax some of these criteria (e.g., follow the same path in the opposite direction, or are similar in every way except the route). In an exemplary embodiment of the present invention, the description of a recurring trip may include the average endpoint location, the path, the average time of day the trip starts, the average trip time, the number of similar trips included and the days of the week observed for this trip.

Detail Description Paragraph:
[0037] The amount of variation accepted impacts whether the results include a somewhat larger or smaller collection of recognized trips. The sources of variability may include navigation errors, traffic variations, parking, and human factors. Navigation errors occur because GPS readings for the same location may vary from about ten to twenty meters. Traffic variations result from the vehicle operator 212 utilizing different lanes and different speeds. Lane choice can introduce a variation of about three to thirty meters and traffic variation in congested urban areas can result in changes in travel time of fifty percent or more from trip to trip. Because many locations have large parking lots and substantial variation in the available spaces, parking variations can result in one hundred meters or more between trips. In an exemplary embodiment of the present invention, the ends of trips are considered to be in the same location if they are less than about one hundred and eighty-six meters apart. In addition, two routes are considered the same if their average separation is less than about forty-seven meters. Also, the start time of a trip matches if it is within one hour of the other and the duration of a trip matches if it is within ten minutes (or alternatively, if the longer duration is at most fifty percent greater). In an alternate exemplary embodiment of the present invention, the matching for some trips is improved by replacing fixed thresholds by tests based on a statistical measurement of the error of a group of points.

Detail Description Paragraph:
[0038] Rule making and revising predictions of likely driver behavior by matching patterns with the trip in progress provide a way to anticipate the vehicle operator's destination and possible routes. In an exemplary embodiment of the present invention, the time and location of the current travel is compared with those previously observed. The time and position are compared as well as the day of the week. For example, if every instance of some prior collection of trips occurred only on Monday through Friday but today is Saturday, the trip would not be a candidate for predicting the destination. In the event that this is the destination, on arrival this trip would probably meet the requirements to be added to the collection and future Saturdays would match. In many cases, multiple trips will match and the frequency and day of week information may be utilized to rank the alternatives.

Detail Description Paragraph:
[0040] In alternate exemplary embodiments of the present invention, applications that provide driving directions to unfamiliar destinations may utilize the driver

behavior model database 208 to adjust the level of detail to the vehicle operator's familiarity with an area. For example, the driving directions could be shortened from a turn-by-turn route the whole way to directions to drive to a familiar location, as determined by the vehicle operator's driving history, and then a turn-by-turn route to the destination from the familiar location. In another alternate exemplary embodiment of the present invention, additional data from sensors on the vehicle 102 may be made available to the system. Additional data useful to the vehicle operator's planning such as those involving service and maintenance (e.g., low fuel levels, imminent breakdowns, vehicle status) may also be utilized when providing feedback to the vehicle operator 212. In addition, speed and steering data may also be utilized to provide dead-reckoning redundancy if the GPS signal is lost.

Detail Description Paragraph:
[0041] FIG. 4 is a block diagram of an exemplary process flow for predicting vehicle operator driving patterns by creating a model of driver activity 416 from raw geographic position data 402. The model of vehicle operator activity 416 is created by the learning engine 106 utilizing the conflict resolution and prediction rules 112. The raw geographic position data 402 includes reports from a navigation device 104 such as a low cost GPS receiver. Each report is a record including data such as the time and date to the second, position coordinates (e.g., latitude and longitude coordinates) and optionally speed and heading. When speed and/or heading are not provided by the navigation device 104, these values may be estimated with a comparison to the time and location reported in the previous record. Whenever a vehicle with a GPS receiver is in use, a series of GPS records form the basis for learning a vehicle operator's driving history. In the discussion that follows, unless otherwise noted, time includes both time and date. In an exemplary embodiment of the present invention, the precision utilized to store position information is accurate to within a few meters (e.g., about eight significant digits) and time is kept accurate to one second over either several months or the useful life of the vehicle (e.g., seven to nine significant digits).

Detail Description Paragraph:
[0042] At step 404 in FIG. 4, event categorization is performed to compare the last few position reports to identify transitions between being parked or stopped and being underway. Output from event categorization, at step 404, includes event facts 406. This process may be supplemented with other information from the vehicle 102 such as whether the vehicle 102 is turned on or off. This recent history may be summarized in a record including the time, position, heading and speed at the previous GPS report. When the vehicle 102 has been stationary, the process also records how long the vehicle 102 has been stationary. When the vehicle 102 is moving, the process also keeps track (e.g., with an ordered list) of all the GPS coordinates en-route. There may be gaps in the reports from the GPS, most commonly because either the GPS power was off (often because the vehicle was off) or loss of a satellite signal due to terrain or buildings. The event facts are records that include: the time and location at the beginning of a trip; the time and location at the completion of a trip; and the route taken. In an exemplary embodiment of the present invention, the route is a record of the sequence of latitude and longitude reports. These outputs and the current GPS report are included in the event facts 406 which are output from the event categorization process at step 404.

Detail Description Paragraph:
[0045] At step 408 in FIG. 4, pattern recognition is performed to record each trip and to compare it to the other trips that have been made. As part of pattern recognition, the learning engine 106 invokes conflict resolution and prediction rules 112. The output from step 408 includes pattern facts 410 that may be stored in the driver behavior model database 208. In the simplest case where the events describe the first or only time a trip has been made, a new pattern fact is created to record the details of the trip. This record contains the starting time and location, ending time and location and the route followed. In an exemplary

embodiment of the present invention, the route information is substantially compressed by eliminating GPS positions that can be interpolated with modest error based on the remaining points. The amount of compression varies with the nature of the roads. For example, long straight roads require fewer positions than winding roads.

Detail Description Paragraph:
[0046] Patterns of trips are recognized in a number of ways, and the following list is not exhaustive of useful patterns. In an exemplary embodiment of the present invention, the approximate time of day is part of the similarity test, so an otherwise identical trip at nine a.m. and three p.m. is seen as two different trips. This is somewhat arbitrary, but may lead to fewer wrong predictions for drivers with different patterns at different times of day. For drivers who make the same trip several times a day, this approach will usually infer multiple patterns, each useful at a different time of day. In the following cases, about the same time of day means within about an hour and about the same driving time means either within about ten minutes or with a ratio between 0.667 and 1.5. The same location means within about one hundred and eighty-six meters. "Take the same route" means that the average distance between the two routes is less than about forty-seven meters. Other values for these tests are possible, but if too low, almost nothing will match and if too high different trips will be treated as matching. These values may be chosen empirically during testing to give reasonable results and may be modified based on actual data. In the case of comparisons to a known group of similar trips, these tests may be improved by basing the test on the standard deviation of the relevant values.

Detail Description Paragraph:
[0047] In an exemplary embodiment of the present invention, two trips are combined into a recognized pattern when they start and end at about the same location, both trips start at about the same time of day, both have about the same driving time and both take the same route. The pattern is recorded based on the average of the start and end locations, the average start time, the average driving time along the route of the first trip, and on the two days of the week the trips were taken (or one day if the same weekday). The record also notes when it is the average of two trips.

Detail Description Paragraph:
[0048] Additional trips will be added to a pattern if the trip matches the pattern in the same way as above. When an additional trip is added the averages, days of the week and the count are adjusted for the additional trip. Other patterns are recognized as a one-time occurrence for a return trip (i.e., start of one is the end of the other and vice versa) with similar travel time and for a trip with the same start and end but a different route. As these patterns are recognized, they are added to the pattern fact database. An exemplary conflict resolution and prediction rule 112 for pattern recognition includes:

Detail Description Paragraph:
[0049] At step 412 in FIG. 4, behavior prediction rules are executed to predict where the current trip is going and the route that will be taken. The output from executing the behavior prediction rules includes knowledge facts 414 that are input into modeling the driver activity 416. This is performed by comparing the time and location at the start of the current driving route with each of the observed and stored patterns located in the driver behavior model database 208 by looking for trips with a similar starting location. In addition, the day of the week can be used to modify the similarity test. For example, if every previous trip in one pattern was on Monday through Thursday but today is Saturday, this pattern is less likely to be the right prediction. If today is Friday, it is more likely than for Saturday, but less than on Wednesday. Several prior patterns may match the current start because of variations in the past due to factors such as traffic, road construction, carpools and doctor's appointments. The relative frequency of the

various alternatives can be utilized to rank the likelihood of the lower scores when the current trip diverges from a predicted route.

Detail Description Paragraph:
[0050] When information about a driver's current plans is available from other sources, it may be possible to make additional projections or better rank the existing predictions. For example, a growing number of people use electronic organizers (e.g., the PALM PILOT) to record their appointments and contact information. With appropriate hardware (e.g. a wireless data link such as BLUE TOOTH) and software in the organizer, an exemplary embodiment of the present invention may request today's appointments and related contact information. For example, a trip starting at 9:15 a.m. and a dentist appointment at 10 a.m. could be the basis for predicting a trip to the dentist. When there have been prior trips to the same appointment, those trips become top predictions. Lacking prior trips, an extending application might extract the dentist's address from the contact data in the organizer and consult a mapping service for the location and recommended routes. An exemplary behavior prediction rule for matching trips includes:

Detail Description Paragraph:
[0051] In an alternate exemplary embodiment of the present invention, the knowledge that has been collected is utilized to provide better information to the vehicle operator 212. For example, in an urban environment, traffic problems may be frequent and unpredictable. Many urban freeways and some major streets now feature real-time data collection of traffic conditions, but delivery of the information to vehicle operators 212 is not very effective. Existing channels for disseminating the information includes radio announcements, television and web pages. Radio often lags fifteen to twenty minutes behind traffic problems and the driver has to listen to reports for the entire region. Television also lags behind, and, like the web, presents a visual distraction that is likely to impair driving. Assuming the traffic data can be distributed digitally to vehicles, knowledge of the vehicle operator's likely route and destination makes it possible to isolate advisories relevant to the current location and predicted route. While GPS information alone can support partial filtering of traffic data, it will require either presenting some unneeded reports or result in some surprises when a driver turns into another road. With knowledge of the possible routes, traffic can be evaluated based on each route, and finally interrupt the vehicle operator with advice at a point where an alternate route is more effective.

Detail Description Paragraph:
[0053] An exemplary embodiment of the present invention may be utilized to anticipate a vehicle operator's behavior. The predicted behavior may then be utilized to make situation specific advice that is more likely to be useful (e.g., warning of traffic problems along likely routes). In addition, the ability to create and manage trip information based solely on the navigation data may eliminate the need for a large local road database or for continuous access to a database service. Understanding a vehicle operator's driving behaviors may facilitate and improve vehicle operator interaction with telematics systems and may also provide the capability of access to information when needed for a myriad of e-commerce and business-to-consumer services. Applications for exemplary embodiments of the present invention include telematics services for a GM Smart Car program to minimize vehicle operators' interaction with complex web-based services. The vehicle operator may automatically interact with the existing e-commerce services (e.g., highway traffic monitor, entertainment, maintenance, hotels) based on the vehicle operator's past driving behavior.

Detail Description Table CWU:
1 IF at the last reported position, speed was nonzero AND GPS now reports zero speed at approximately the same location THEN forget these old facts AND the last reported position is now the time and position reported by the GPS with zero speed AND increment the time spent stationary by the time between the last report and

now.

Detail Description Table CWU:
2 IF the GPS reports travel at over 3 MPH, and close to the last reported position THEN forget these old facts AND the last reported position is now the time, speed and position reported by the GPS on the heading from the last position to the current position ALSO, IF vehicle had been at the old position for 6 minutes or more (implies vehicle was parked), add to the database the facts A trip came to an end at the old position when vehicle first stopped A new trip began at the old position at the time reported by the GPS minus the estimated time to get from the last position to here

Detail Description Table CWU:
3 /* See-first-repeat: IF there are two trips made: AND both starting at about the same time of day; AND both take about the same time to drive; AND both start at about the same location and end at about the same location; AND the routes match; THEN replace the record of the two trips with a regular-trip with these properties: It starts at the average location and time of day the two trips started; It ends at the average location the two trips ended; It follows the route of the first trip; The driving time is the average of the two trips; It happens on the days of the week the trips did; It happens twice.

Detail Description Table CWU:
4 WHEN starting a trip now AND there is a regular-trip that starts close to the same place AND at about the same time of day AND the day of the week today fits the pattern of weekdays in the regular-trip THEN PREDICT a destination as the destination of this regular-trip via the route in the regular trip AND an arrival time as now plus the average trip time AND give it a ranking score as the number of times this regular-trip occurred Adjusting for day of week uncertainly (e.g. seen Monday and Tuesday but today is Thursday)

Detail Description Table CWU:
5 /* Warn about traffic: If passing the current position and heading along a predicted route to the freeway traffic advisory API returns "traffic speed ahead under 16 MPH" THEN mark predicted route as JAMMED /* Divert driver: IF a predicted route is JAMMED AND another predicted route to the same destination is not JAMMED AND this is the most likely destination AND current position is approaching the point where the two routes diverge THEN advise driver to take the other route

CLAIMS:

1. A method for predicting vehicle operator destinations, the method comprising: receiving vehicle position data for a vehicle; comparing said vehicle position data for a current trip to vehicle position data for a previous trip to predict a destination for said vehicle; and suggesting a path to said destination.

2. The method of claim 1 wherein said comparing includes performing event categorization and pattern recognition.

4. The method of claim 2 wherein said pattern recognition includes combining said current trip and said previous trip.

6. The method of claim 1 wherein said previous trip includes a starting time and location, an ending time and location, and route data including a plurality of said previous position data.

7. The method of claim 1 wherein said vehicle position data includes navigation coordinates.

8. The method of claim 7 wherein said navigation coordinates are GPS coordinates.

9. The method of claim 1 wherein said vehicle position data includes a time stamp, a date stamp and navigation coordinates.

10. The method of claim 1 wherein said vehicle position data further includes a vehicle heading and a vehicle speed.

16. The method of claim 1 wherein said receiving occurs once during each pre-selected time interval.

17. The method of claim 1 wherein said receiving occurs in response to said vehicle moving a pre-selected distance.

19. A system for predicting vehicle operator destinations, the system comprising: a navigation device; a storage device; a microprocessor in communication with said navigation device and said storage device, said microprocessor including instructions to implement the method comprising: receiving vehicle position data for a vehicle via said navigation device; comparing said vehicle position data for a current trip to vehicle position data for a previous trip to predict a destination for said vehicle, said vehicle position data for a previous trip stored in said storage device; and suggesting a path to said destination.

20. The system of claim 19 wherein said navigation device is a GPS receiver.

22. A computer program product for predicting vehicle operator destinations, the product comprising: a storage medium readable by a processing circuit and storing instructions for execution by the processing circuit for performing a method comprising: receiving vehicle position data for a vehicle; comparing said vehicle position data for a current trip to vehicle position data for a previous trip to predict a destination for said vehicle; and suggesting a path to said destination.

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L38: Entry 7 of 7 File: USPT Feb 25, 2003

US-PAT-NO: 6526349
DOCUMENT-IDENTIFIER: US 6526349 B2

TITLE: Method of compiling navigation route content

DATE-ISSUED: February 25, 2003

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Search Selected Search ALL Clear

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ART-UNIT: 3661

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ABSTRACT:

A method of compiling navigation route content (202) in a distributed communications system (100) includes defining a navigation route (306) between a starting location (302) and a destination location (304) that is comprised a plurality of route links (320-332) and defined by a user of a remote communications node (104). The plurality of route links (320-332) are monitored and navigation route content (202) is recorded for each of the route links. Navigation route content (202) is compiled by a navigation route algorithm (204) and navigation route data (206) is calculated for the navigation route (306) between starting location (302) and destination location (304).

36 Claims, 5 Drawing figures

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L38: Entry 7 of 7 File: USPT Feb 25, 2003

DOCUMENT-IDENTIFIER: US 6526349 B2
TITLE: Method of compiling navigation route content

Brief Summary Text (4):
Vehicle drivers seek to find the optimum routes from their origin point to their destination point so they can minimize travel time and fuel consumption. Current methods for finding optimum routes are based on static digital road map databases and limited real-time traffic monitoring equipment. Typically, the road map data is used to compute optimal routes based on estimated travel times from the road classification and/or speed limit data. This method has the disadvantage in that the data may not reflect the actual travel times because of stop signs, normal traffic patterns, weather and road conditions, accidents, construction, and the like. Real-time traffic monitoring equipment is currently available only on some major freeways and arteries. This leaves potential routes out of reach of real-time traffic monitoring and hence unreliable for incorporation into a route optimization scheme.

Brief Summary Text (5):
Optimum routes are generally computed based on weighting strategies for road segments and intersections. The real-time traffic information is treated as a dynamic weight for the individual road segments affected and routes can be computed taking the traffic into consideration where available. These route calculation methods are based on available static data and limited real-time traffic information. This has the disadvantage of improper weighting of road segments due to a lack of real-time traffic data for any given time of the day or week, which in turn creates sub-optimal routing schemes.

Detailed Description Text (9):
Traffic servers 142 can contain traffic information including, but not limited to, traffic reports, traffic conditions, speed data, and the like. Route servers 140 can contain information including, but not limited to, digital road map data, route alternatives, route guidance, route algorithms, route storing algorithms, and the like. Communications node gateway 138 is also coupled to map databases 146, which can comprise distributed map database and traffic databases 148. Map databases 146 contain additional digital roadmap data. Traffic databases 148 can contain traffic information, for example, traffic conditions, road closures, construction, and the like. POI servers 144 can contain information for points of interests such as gasoline stations, restaurants, motels, movie theaters, and the like.

Detailed Description Text (12):
Communications node gateway 138 is coupled to remote communications node gateway 136. Remote communications node gateway 136 is coupled to various navigation applications, which can include, without limitation, route guidance application(s) 128, traffic application(s) 130, POI application(s) 132, navigation route algorithm 204, route storing algorithm 123, and the like. Navigation applications 128, 130, 132, 204, 123 are coupled to, and can process data received from internal and external positioning device(s) 134. Internal positioning device(s) 134 are located within remote communications node 104 or vehicle 108 and can include, for example

global positioning system (GPS) unit(s), speedometer, compass, gyroscope, altimeter, and the like. Examples of positioning device(s) 134 external to remote communications node 104 are, without limitation, differential GPS, network-assisted GPS, wireless network positioning systems, and the like.

Detailed Description Text (15):
Remote communications node 104 can optionally contain and control one or more digital storage devices 126 to which real-time broadcasts and navigational data can be digitally recorded. The storage devices 126 may be hard drives, flash disks, or other storage media. The same storage devices 126 can also preferably store digital data that is wirelessly transferred to remote communications node 104 in faster than real-time mode.

Detailed Description Text (16):
In FIG. 1, communications node 102 and remote communications node 104, perform distributed, yet coordinated, control functions within distributed communications system 100. Elements in communications node 102 and elements in remote communications node 104 are merely representative, and distributed communications system 100 can comprise many more of these elements within other communications nodes and remote communications nodes.

Detailed Description Text (20):
Navigation route content 202 can include, without limitation, position data, velocity data, time data, and the like, received real-time from any portion of a navigation route traveled by remote communications node 104 or selected by a user via user configuration device 116. Examples of time data include, but are not limited to total travel time of the navigation route 306, intermediate travel times of individual route links, time of day, day of the week, and the like. Examples of velocity data include, but are not limited to average velocity, instantaneous velocity, and the like, which can also be for a given time of day or day of the week. Position data can include two-dimensional or three-dimensional coordinate data of the position of remote communications node 104. Navigation route content 202 is based on a navigation route defined by a user of remote communications node 104 in a distributed communications system 100.

Detailed Description Text (21):
Navigation anomaly data 208 can include real-time traffic data collected using installed sensors along or in the road, video cameras, accident reports, airborne traffic monitors, and the like. Traffic incidents such as accidents, stalls, construction, weather, delays, and the like, are reported with a location associated with a road segment in a digital map database.

Detailed Description Text (22):
Navigation route data 206 can include, without limitation, information on route links associated with a particular navigation route. For example, navigation route data 206 can include position data, velocity data, time data and the like already collected from remote communications node 104. Navigation route data 206 can also include historical travel time data from traffic observations aggregated over time from one or more users. Navigation route data 206 can also include data from static digital road map databases, road segments, route links, and the like. Road segments are elements in a digital road map database that represent route links in the actual road network. Route links are defined as sections of the roadway between intersections. Route links are road segments that are incorporated into a computed or defined navigation route. Navigation route data 206 computed by navigation route algorithm 204 can be processed to provide optimum navigation route 210, which can be a set of route links that optimizes or minimizes travel time, travel distance, and the like, between a starting location and a destination location. The invention is not limited to minimizing travel time or distance traveled. Other factors can also be maximized, minimized, and the like, and are within the scope of the invention.

Detailed Description Text (25):
In operation, a user of remote communications node 104 defines navigation route 306 between starting location 302 and destination location 304 either directly or indirectly. Navigation route 306 is comprised of a plurality of route links 320, 322, 324, 326, 328, 330 and 332 (hereinafter designated 320-332). The user can define navigation route 306 by, for example, logging onto a trip planning website on distributed communications system 100 via user configuration device 116 and entering starting location 302 and destination location 304. Various routes between starting location 302 and destination location 304 stored in communications node 102, specifically route servers 140, and are communicated to the user. The user can then select a route offered or modify the route by adding and deleting route links as needed. When the navigation route 306 is complete, it is saved at communications node 102 and communicated to remote communications node 104. This is an example of a user directly defining navigation route 306.

Detailed Description Text (27):
Another example of defining navigation route includes a user driving a vehicle 108 with remote communications node 104 normally in his/her daily activities. Utilizing positioning devices 134, navigation route algorithm 204 and route storing algorithm 123 in remote communications node 104, the start and stop times, locations, and the like, of remote communications node 104 are recorded, for example, by monitoring the on/off position of the ignition switch of vehicle 108. Starting location 302 is compared to any previously defined starting location 308 and flagged if starting location is within a certain distance or radius 310 of previously defined starting location 308. If starting location is flagged, route storing algorithm 123 will begin recording navigation route content 202. Destination location 304 is compared to any previously defined destination location 312 and flagged if destination location 304 is within a certain distance or radius 314 of previously defined destination location 312. If destination location 304 is flagged, remote communications node 104 and route storing algorithm 123 will end recording of navigation route content 202. Navigation route content 202 for navigation route 306 is then stored and communicated to communications node 102 immediately or at some future time. If destination location 304 is not flagged as being within radius 314 of previously define destination location 312, remote communications node 104 can either keep navigation route content 202 recorded and define a new navigation route 306 or discard navigation route content 202 already recorded since it did not correspond to a previously traveled navigation route. When a recurring route is identified and communicated to communications node 102, the navigation route data 206 can be used to match the specific route links used in the route. This is an example of indirectly defining navigation route 306 by automatically monitoring the driving pattern of an individual user via remote communications node 104. Radius 310, 312 can be defined by a user or be assigned a default value for any particular starting location 302 or destination location 304.

Detailed Description Text (28):
Once a navigation route 306 is defined, plurality of route links 320-332 can be overlaid onto digital roadmap 360 for ease of viewing and editing. The defining coordinates of route links 320-332 can then be communicated to the remote communications node 104. Once a navigation route 306 is communicated to the remote communications node 104, plurality of route links 320-332 traversed by remote communications node 104 are monitored. When the starting location 302 and destination location 304 comport with previously defined starting and destination locations 308, 312 as described above, navigation route content 202 is recorded for each of the plurality of route links 320-332. Navigation route content 202 is recorded at intervals 350 along navigation route 306. Intervals 350 can be regular or irregular and can be defined by a user or automatically via route storing algorithm 123. Intervals 350 can be defined by distance traveled, time elapsed, changes in speed or direction, passing the coordinates of the end points of route links 320-332, and the like. Intervals 350 can also be defined by any distance or

time between the end points of route lines 320-332. For example, intervals can be defined at each route alternative, which is at each point along one or more route links 320-332 where an alternate route diverges from route links 320-322. Navigation route content 202 is also communicated to communications node 102 and stored at regular intervals. The distance and/or time between intervals can be adjusted so that route storing algorithm can identify individual route links 320-332 along navigation route 306 to ensure navigation route content 202 is as accurate and precise as possible. In a preferred embodiment, the time to travel between pairs of end points of each route link is stored when the coordinates of the route links are available in remote communications node 104. Using these points to measure the travel times will make it convenient and accurate when the navigation route content 202 is compiled and interpreted by navigation route algorithm 204. As an example, and without limitation, navigation route content 202, which can include time data (time of day, week, etc.), velocity data (speed and direction) and position data (GPS coordinates, and the like) is recorded at intervals and communicated to communications node 102.

Detailed Description Text (29):
Navigation route content 202 can be communicated to communications node 102 at convenient time intervals throughout the day, week, and the like. For example, navigation route content 202 can be communicated to communications node 102 on a daily basis, weekly basis, or when the user of remote communications node 104 is utilizing another service. In one embodiment, navigation route content 202 is communicated to communications node 102 before or after a navigation route 306 is downloaded to remote communications node 104. However, the scope of the invention includes communicating navigation route content 202 to communications node 104 at any time or any number of intervals to provide for efficient communication of navigation route content 202.

Detailed Description Text (31):
Utilizing navigation route data 206, an optimum navigation route 210 can be generated between starting location 302 and destination location 304. Navigation route algorithm 204 can select the plurality of route links 320-332 that minimize travel time, travel distance, and the like, between starting location 302 and destination location 304. When optimizing navigation route 306, navigation route algorithm 204 can incorporate navigation anomaly content including real-time traffic incidents such as accidents, construction, weather and the like. Therefore, an optimum navigation route 210 can change depending on real-time conditions and the continuous input of navigation route content 202 received from users of a specific navigation route 306 between starting location 302 and destination location 304.

Detailed Description Text (32):
Optimum navigation route 210 and navigation route data 206 can also be utilized to predict arrival time at destination location 304 from a given departure time from starting location 302. The arrival time can be updated via remote communications node 104 during the journey as additional navigation route content 202 and navigation anomaly content 208 are received at communications node 102, compiled and communicated to remote communications node 104.

Detailed Description Text (33):
Optimum navigation route 210 and navigation route data 206 can also be utilized to predict an optimum departure time from starting location 302 to destination location 304 that will minimize travel time or distance or the like.

Detailed Description Text (34):
Navigation route data 206 can also be utilized to predict alternate routes besides optimum navigation route 210 that may be more optimum at a given time due to navigation anomaly content 208. The alternate route can be communicated automatically to remote communications node 104 or user configuration device 116.

Detailed Description Text (41):
In step 518, navigation route content 202 is compiled and stored by navigation route algorithm 204. In step 520, navigation route data 206 is calculated from navigation route content 202 for navigation route 306 between starting location 302 and destination location 304. Navigation route data 206 can be historical and predictive data for navigation route 306 so that future users can make use of it to plan trips. In step 522, plurality of route links 320-332 of navigation route 306 are overlaid onto digital roadmap 360 for ease of use and editing by users.

Detailed Description Text (42):
In step 524, navigation route data 206 is optimized for navigation route 306 so as to provide plurality of route links 320-332 to operate to minimize travel time, travel distance, and the like between starting location 302 and destination location 304. In optimizing, navigation anomaly content 208 is also input into navigation route algorithm to account for real-time traffic incidents and other delays on an otherwise optimized route. This can have the effect of changing the plurality of route links that culminate in optimum navigation route 210. The foregoing steps can be repeated as often as necessary per the return arrow 526.

Detailed Description Text (44):
The method of the invention offers the advantage of collecting actual travel information from users and using that information as a component of generating customized traffic reports and optimizing navigation routes. The method of the invention also has the advantage of knowing and tracking the plurality of route links being traveled precisely including position, time and velocity data for each of the route links. This allows the creation of a highly accurate and optimized navigation route data that is updated in real-time by a plurality of users defining their own navigation routes. This has the advantage of allowing navigation route algorithm 204 to calculate an increasingly optimal navigation route for use by existing and subsequent users of the roadway network and allowing users to save additional time and cost in reaching their destinations.

Current US Original Classification (1):
701/209

Current US Cross Reference Classification (1):
701/200

CLAIMS:

1. A method of compiling navigation route content in a distributed communications system having a remote communications node, the method comprising: defining a navigation route between a starting location and a destination location, wherein the navigation route is comprised of a plurality of route links and wherein the navigation route is defined by a user of the remote communications node; monitoring the plurality of route links traversed by the remote communications node; determining if the starting location is within a radius of a previously defined starting location, and wherein the remote communications node begins recording the navigation route content if the starting location is within the radius of the previously defined starting location, and wherein recording the navigation route content of each of the plurality of route links occurs in at least one of: as the plurality of route links are traversed by the remote communications node; and in real-time; determining if the destination location is within a radius of a previously defined destination location, and wherein the remote communications node ends recording the navigation route content if the destination location is within the radius of the previously defined destination location; compiling the navigation route content into a navigation route algorithm; and calculating navigation route data for the navigation route between the starting location and the destination location.

4. The method of claim 1, wherein the navigation route content comprises position data for each of the plurality of route links of the navigation route.

6. The method of claim 1, wherein the navigation route content comprises time data for each of the plurality of route links of the navigation route.

10. The method of claim 1, further comprising optimizing the navigation route utilizing the navigation route data, wherein the navigation route algorithm selects the plurality of route links to minimize travel time between the starting location and the destination location.

11. The method of claim 1, further comprising optimizing the navigation route utilizing the navigation route data, wherein the navigation route algorithm selects the plurality of route links in order to minimize travel distance between the starting location and the destination location.

12. A computer-readable medium containing computer instructions for instructing a processor to perform a method of compiling navigation route content in a distributed communications system having a remote communications node, the instructions comprising: defining a navigation route between a starting location and a destination location, wherein the navigation route is comprised of a plurality of route links and wherein the navigation route is defined by a user of the remote communications node; monitoring the plurality of route links traversed by the remote communications node; determining if the starting location is within a radius of a previously defined starting location, and wherein the remote communications node begins recording the navigation route content if the starting location is within the radius of the previously defined starting location, and wherein recording the navigation route content of each of the plurality of route links occurs in at least one of: as the plurality of route links are traversed by the- remote communications node; and in real-time; determining if the destination location is within a radius of a previously defined destination location, and wherein the remote communications node ends recording the navigation route content if the destination location is within the radius of the previously defined destination location; compiling the navigation route content into a navigation route algorithm; and calculating navigation route data for the navigation route between the starting location and the destination location.

15. The computer-readable medium in claim 12, wherein the navigation route content comprises position data for each of the plurality of route links of the navigation route.

17. The computer-readable medium in claim 12, wherein the navigation route content comprises time data for each of the plurality of route links of the navigation route.

21. The computer-readable medium in claim 12, further comprising optimizing the navigation route utilizing the navigation route data, wherein the navigation route algorithm selects the plurality of route links to minimize travel time between the starting location and the destination location.

22. The computer-readable medium in claim 12, further comprising optimizing the navigation route utilizing the navigation route data, wherein the navigation route algorithm selects the plurality of route links in order to minimize travel distance between the starting location and the destination location.

23. A method of providing navigation route content in a distributed communications system having a remote communications node, the method comprising: providing means for defining a navigation route between a starting location and a destination location, wherein the navigation route is comprised of a plurality of route links

and wherein the navigation route is defined by a user of the remote communications node; providing means for monitoring the plurality of route links traversed by the remote communications node; providing means for determining if the starting location is within a radius of a previously defined starting location, and wherein the remote communications node begins recording the navigation route content if the starting location is within the radius of the previously defined starting location, and wherein recording the navigation route content of each of the plurality of route links occurs in at least one of: as the plurality of route links are traversed by the remote communications node; and in real-time; providing means for determining if the destination location is within a radius of a previously defined destination location, and wherein the remote communications node ends recording the navigation route content if the destination location is within the radius of the previously defined destination location; providing means for compiling the navigation route content into a navigation route algorithm; and providing means for calculating navigation route data for the navigation route between the starting location and the destination location.

26. The method of claim 23, wherein the navigation route content comprises position data for each of the plurality of route links of the navigation route.

28. The method of claim 23, wherein the navigation route content comprises time data for each of the plurality of route links of the navigation route.

32. The method of claim 23, further comprising providing means for optimizing the navigation route utilizing the navigation route data, wherein the navigation route algorithm selects the plurality of route links to minimize travel time between the starting location and the destination location.

33. The method of claim 23, further comprising providing means for optimizing the navigation route utilizing the navigation route data, wherein the navigation route algorithm selects the plurality of route links in order to minimize travel distance between the starting location and the destination location.

34. The method of claim 1, further comprising communicating the navigation route content to a communications node at a time interval.

35. The computer-readable medium of claim 12, further comprising communicating the navigation route content to a communications node at a time interval.

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